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MILITARY STANDARD

ELECTRO–ACOUSTICAL, MECHANICAL AND ENVIRONMENTAL TEST METHODS FOR AUDIO OR ACOUSTICAL COMPONENT PARTS

FSC 5965

DEPARTMENT OF DEFENSE
WASHINGTON, D.C. 20301

Electro-Acoustical, Mechanical and Environmental Test Methods for Audio or Acoustical Component Parts.

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

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Electronic Systems Command, ATTN: ELEX 5043, Department of the Navy, Washington, D.C. 20360 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

CONTENTS

1. INTRODUCTION

1.1 Scope. This standard establishes uniform methods for testing audio and acoustical component parts, including basic environmental tests to determine resistance to deleterious effects of natural elements and conditions surrounding military operations, and physical and electrical tests. For the purpose of this standard, the term "component parts" includes such items as loudspeakers, handsets, headsets, earphones, microphones, etc. This standard is intended to apply only to such parts or parts used in connection with such parts (eg. hearing protectors and wiring harnesses). The test methods described herein have been prepared to serve several purposes.

a. To specify suitable conditions obtainable in the laboratory which give test results equivalent to the actual service conditions existing in the field, and to obtain reproducibility of the results of tests. The tests described herein are not to be interpreted as an exact and conclusive representation of actual service operation in any one geographic location, since it is known that the only true test for operation in a specific location is an actual service test at that point.

b. To describe in one standard (1) all of the test methods of a similar character which appeared in the various joint or single-service audio or acoustical component-parts specifications, and (2) those newly-developed test methods which are feasible for use in several specifications. By so consolidating, these methods may be kept uniform and thus result in conservation of equipment, man-hours, and testing facilities. In achieving these objectives, it is necessary to make each of the general tests adaptable to a broad range of audio or acoustical component parts.

c. The test methods described herein for audio and acoustical characteristics of component parts shall also apply, when applicable, to parts not covered by an approved military specification, military sheet-form standard, specification sheet, or drawing.

1.2 Numbering system. The test methods are designated by numbers assigned in accordance with the following system:

1.2.1 Class of tests. The tests are divided into three classes: Test methods numbered 101 to 199 inclusive, cover electro-acoustical tests; those numbered 201 to 299 inclusive, cover physical-characteristics tests; and those numbered 301 to 399 inclusive, cover environmental tests. Within each class, test methods are serially numbered in the order in which they are introduced into this standard.

1.2.2 Revision of test methods. Revisions of test methods are indicated by a letter following the method number. For example, the original number assigned to the Insulation Resistance test method is 102; the first revision of that method is 102A, the second revision, 102B, etc.

1.3 Method of reference. When applicable, test methods contained herein shall be referenced in the individual specification by specifying this standard, the method number, and the details required

in the summary paragraph of the applicable method. To avoid the necessity for changing specifications which refer to this standard, the letter following the method number shall not be used when referencing test methods. For example, use 102, not 102A.

2. GENERAL REQUIREMENTS

2.1 Test requirements. The requirements which must be met by the component parts subjected to the test methods described herein are specified in the individual specifications, as applicable, and the tests shall be applied as specified therein. Whenever this standard conflicts with the individual specification, the latter shall govern.

2.2 Test conditions. Unless otherwise specified herein, or in the individual specification, all measurements and tests shall be made at temperatures of 15° C to 35° C (59°F to 95°F) at air pressure of 650 to 800 millimeters of mercury, and relative humidity of 45 percent to 75 percent. Whenever these conditions must be closely controlled in order to obtain reproducible results: for reference purposes, temperature, relative humidity, and atmospheric pressure conditions of 23° ±1°C (73.4°F ±1.9°F), 50 percent ±2 percent, and 650 to 800 millimeters of mercury, shall be specified.

2.2.1 Permissible temperature variation in environmental chambers. When chambers are used, specimens under test shall be located only within the working area defined as follows:

a. Temperature variation within working area: The controls for the chambers shall be capable of maintaining the temperature of any single reference point within the working area within ±2°C (3.5°F).

b. Space variation within working area: Chambers shall be so constructed that, at any given time, the temperature of any point within the working area shall not deviate more than 3°C (5.4°F) from the reference point, except for the immediate vicinity of specimens generating heat.

2.3 Reference conditions. Reference conditions as a base for calculations shall be 20°C (68°F) for temperature, 760 millimeters of mercury for air pressure, and not applicable for relative humidity.

3. Sequence of tests (not mandatory). The sequence of tests which follows is for guidance to new specification writers who may not know of the philosophy that parts should ideally be mechanically and thermally stressed prior to being subjected to a moisture resistance test. Within any of the three groups and sub-groups which follow, the order is preferred but not mandatory. It is recommended that this sequence be followed in all new specifications and when feasible, in revisions of existing specifications.

Group I (all of the samples)
- Visual inspection
- Mechanical inspection
- Electrical measurements

Group IIa (part of sample)
- Gunblast

Group IIb (balance of sample)

Group III (all samples that have passed Group II test)
- Moisture resistance test

4. Drawing notes:

1. Dimensions are in inches.
2. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm, unless otherwise specified.

4. NUMERICAL INDEX OF TEST METHODS

Method number	Date	Title
		Electro-acoustical tests (100 Class)
101		Dielectric withstanding voltage
102		Insulation resistance
103		DC resistance
104		Resistance-temperature characteristic
105		Frequency response
106		Impedance (Resistive Substitution)
		Physical-characteristics tests (200 Class)
		Environmental tests (300 Class)

(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 officers.)

METHOD 101

DIELECTRIC WITHSTANDING VOLTAGE

1. PURPOSE. The dielectric withstanding voltage test (also called high-potential, over potential, voltage-breakdown, or dielectric-strength test) consists of the application of a voltage higher than rated voltage for a specific time between mutually insulated portions of a component part or between insulated portions and ground. This is used to prove that the component part can operate safely at its rated voltage and withstand momentary overpotentials due to switching, surges, and other similar phenomena. Although this test is often called a voltage breakdown or dielectric-strength test, it is not intended that this test cause insulation breakdown or that it be used for detecting corona, rather it serves to determine whether insulating materials and spacings in the component part are adequate. When a component part is faulty in these respects, application of the test voltage will result in either disruptive discharge or deterioration. Disruptive discharge is evidenced by flashover (surface discharge), sparkover (air discharge), or breakdown (puncture discharge). Deterioration due to excessive leakage currents may change electrical parameters or physical characteristics.

1.1 Precautions. The dielectric withstanding voltage test should be used with caution particularly in inplant quality conformance testing, as even an overpotential less than the breakdown voltage may injure the insulation and thereby reduce its safety factor. Therefore, repeated application of the test voltage on the same specimen is not recommended. In cases when subsequent application of the test potential is specified in the test routine, it is recommended that the succeeding tests be made at reduced potential. When either alternating-current (ac) or direct-current (dc) test voltages are used, care should be taken to be certain that the test voltage is free of recurring transients or high peaks. Direct potentials are considered less damaging than alternating potentials which are equivalent in ability to detect flaws in design and construction. However, the latter are usually specified because high alternating potentials are more readily obtainable. Suitable precautions must be taken to protect test personnel and apparatus because of the high potentials used.

1.2 Factors affecting use. Dielectric behavior of gases, oils, and solids is affected in various degrees by many factors, such as atmospheric temperature, moisture, and pressure; condition and form of electrodes; frequency, waveform, rate of application, and duration of test voltage; geometry of the specimen; position of the specimen (particularly oil-filled components); mechanical stresses; and previous test history. Unless these factors are properly selected as required by the type of dielectric, or suitable correction factors can be applied, comparison of the results of individual dielectric withstanding voltage tests may be extremely difficult.

2. APPARATUS

2.1 High-voltage source. The nature of the potential (ac or dc) shall be as specified. When an alternating potential is specified, the test voltage provided by the high-voltage source shall be nominally 60 hertz in frequency and shall approximate, as closely as possible, a true sine wave in form. Other commercial power frequencies may be used for inplant quality conformance testing, when specified. All alternating potentials shall be expressed as root-mean-square values, unless otherwise specified. The kilovolt-ampere rating and impedance of the source shall be such as to permit operation at all testing loads without serious distortion of the waveform and without serious change in voltage for any setting. When the test specimen demands substantial test source power capacity, the regulation of the source shall be specified. When a minimum kilovoltampere rating is required, it shall be specified. When a direct potential is specified, the ripple content shall not exceed 5 percent rms of the test potential. When required, a suitable current-limiting device shall be used to limit current surges to the value specified.

2.2 Voltage measuring device. A voltmeter shall be used to measure the applied voltage to an accuracy of at least 5 percent, unless otherwise specified. When a transformer is used as a high-voltage source of alternating potential, a voltmeter connected across the primary side or across a tertiary winding may be used provided it is previously determined that the actual voltage across the test specimen will be within the allowable tolerance under any normal load condition.

2.3 Leakage current measuring device. When any leakage current requirement is specified, a suitable method shall be used to measure the leakage current to an accuracy of at least 5 percent of the specified requirement.

2.4 Fault indicator. Suitable means shall be provided to indicate the occurrence of disruptive discharge and leakage current in case it is not visually evident in the specimen. The voltage measuring device of 2.2, the leakage current measuring device of 2.3, or an appropriate indicator light or an overload protective device may be used for this purpose.

3. PROCEDURE.

3.1 Preparation. When special preparations or conditions such as special test fixtures, reconnections, grounding, isolation, or immersion in water are required, they shall be specified.

3.2 Test voltage. Specimens shall be subjected to a test voltage of the magnitude and nature (ac or dc) specified.

3.3 Points of application. The test voltage shall be applied between mutually insulated portions of the specimen or between insulated portions and ground as specified. The method of connection of the test voltage to the specimen should be specified only when it is a significant factor.

3.4 Rate of application. The test voltage shall be raised from zero to the specified value as uniformly as possible, at a rate of approximately 500 volts (rms or dc) per second, unless otherwise specified. At the option of the manufacturer, the test voltage may be applied instantaneously during implant quality conformance testing.

3.5 Duration of application. Unless otherwise specified, the test voltage shall be maintained at the specified value for a period of 15 seconds for qualification testing. Specimens with movable parts shall be tested as specified, in a manner to assure that repeated stresses are not applied to the same dielectric. Upon completion of the test, the test voltage shall be gradually reduced to avoid voltage surges. At the option of the manufacturer, the test voltage may be removed instantaneously during inplant quality conformance testing.

3.6 Examination and measurement of specimen. During the dielectric withstanding voltage test, the fault indicator shall be monitored for evidence of disruptive discharge and leakage current. Following this, the specimen shall be examined and measurements shall be performed to determine the effect of the dielectric withstanding voltage test on specific operating characteristics, when specified.

4. SUMMARY. The following details are to be specified in the individual specification:

a. Special preparations or conditions, if required (see 3.1).

b. Magnitude of test voltage (see 3.2).

c. Nature of potential (ac or dc) (see 2.1).

d. Duration of application of test voltage for qualification testing if other than 60 seconds (see 3.5).

e. Points of application of test voltage (see 3.3).
   (1) Method of testing specimens with movable parts (see 3.5).

f. Method of connection of test voltage to specimen, if significant (see 3.3).

g. Regulation, when applicable (see 2.1).

h. Minimum kilovolt-ampere rating of high-voltage source, if required (see 2.1).

i. Limiting value of surge current, if applicable (see 2.1).

j. Maximum leakage current requirement, if applicable (see 2.3).

k. Measurements after dielectric withstanding voltage test, if required (see 3.6).

METHOD 102

INSULATION RESISTANCE

1. PURPOSE. This test is to measure the resistance offered by the insulating members of a component part to an impressed direct voltage tending to produce a leakage of current through or on the surface of these members. A knowledge of insulation resistance is important, even when the values are comparatively high, as these values may be limiting factors in the design of high-impedance circuits. Low insulation resistances, by permitting the flow of large leakage current, can disturb the operation of circuits intended to be isolated, for example, by forming feedback loops. Excessive leakage currents can eventually lead to deterioration of the insulation by heating or by direct-current electrolysis. Insulation-resistance measurements should not be considered the equivalent of dielectric withstanding voltage or electric breakdown tests. A clean, dry insulation may have a high insulation resistance, and yet possess a mechanical fault that would cause failure in the dielectric withstanding voltage test. Conversely, a dirty, deteriorated insulation with a low insulation resistance might not break down under a high potential. Since insulating members composed of different materials or combinations of materials may have inherently different insulation resistances, the numerical value of measured insulation resistance cannot properly be taken as a direct measure of the degree of cleanliness or absence of deterioration. The test is especially helpful in determining the extent to which insulating properties are affected by deteriorative influences, such as heat, moisture, dirt, oxidation, or loss of volatile materials.

1.1 Factors affecting use. Factors affecting insulation-resistance measurements include temperature, humidity, residual charges, charging currents of time constant of instrument and measured circuit, test voltage, previous conditioning, and duration of uninterrupted test voltage application (electrification time). In connection with this last-named factor, it is characteristic of certain components (for example, capacitors and cables) for the current to usually fall from an instantaneous high value to a steady lower value at a rate of decay which depends on such factors as test voltage, temperature, insulating materials, capacitance, and external circuit resistance. Consequently, the measured insulation resistance will increase for an appreciable time as test voltage is applied uninterruptedly. Because of this phenomenon, it may take many minutes to approach maximum insulation-resistance readings, but specifications usually require that readings be made after a specified time, such as 1 or 2 minutes. This shortens the testing time considerably while still permitting significant test results, provided the insulation resistance is reasonably close to steady-state value, the current versus time curve is known, or suitable correction factors are applied to these measurements. For certain components, a steady instrument reading may be obtained in a matter of seconds. When insulation-resistance measurements are made before and after a test, both measurements should be made under the same conditions.

2. APPARATUS. Insulation-resistance measurements shall be made on an apparatus suitable for the characteristics of the component to be measured such as a megohm bridge, megohm-meter, insulation-resistance test set, or other suitable apparatus. Unless otherwise specified, the direct potential applied to the specimen shall be that indicated by one of the following test condition letters, as specified.

Test condition	Test potential
A	100 volts ±10%
B	500 volts ±10%
C	1,000 volts ±10%

For inplant quality conformance testing, any voltage may be used provided it is equal to or greater than the minimum potential allowed by the applicable test condition. Unless otherwise specified, the measurement error at the insulation-resistance value required shall not exceed 10 percent. Proper guarding techniques shall be used to prevent erroneous readings due to leakage along undesired paths.

3. PROCEDURE. When special preparations or conditions such as special test fixtures, reconnections, grounding, isolation, low atmospheric pressure, humidity, or immersion in water are required, they shall be specified. Insulation-resistance measurements shall be made between the mutually insulated points or between insulated points and ground, as specified. When electrification time is a factor, the insulation-resistance measurements shall be made immediately after a 2-minute period of uninterrupted test voltage application, unless otherwise specified. However, if the instrument-reading indicates that an insulation resistance meets the specified limit, and is steady or increasing, the test may be terminated before the end of the specified period. When more than one measurement is specified, subsequent measurements of insulation resistance shall be made using the same polarity as the initial measurements.

4. SUMMARY. The following details are to be specified in the individual specification:

a. Test condition letter, or other test potential, if specified (see 2).

b. Special preparations or conditions, if required (see 3).

c. Points of measurement (see 3).

d. Electrification time, if other than 2 minutes (see 3).

e. Measurement error at the insulation-resistance value required, if other than 10 percent (see 2).

METHOD 103

DC RESISTANCE

1. PURPOSE. This test is to measure the direct-current (dc) resistance of resistors, electromagnetic windings of components, and conductors. It is not intended that this test apply to the measurement of contact resistance.

1.1 Precautions. The temperature at which the dc resistance measurement is made will affect the final value of resistance. In addition, resistance values may vary with the measuring voltage.

2. PROCEDURE. DC resistance shall be measured with a resistance bridge or other suitable test equipment. The limit of error in the bridge or other test equipment shall not exceed one-tenth of the specified tolerance on the measured resistance (for example, the limit of error in the bridge or other test equipment shall not exceed ±0.5 percent if the specified tolerance on the measured resistance is ±5 percent), unless otherwise specified. For inplant quality conformance testing, the accuracy of the measurement shall be such to insure that the resistance value is within the required tolerance. If a plus or minus tolerance is not specified, the limit of error in the bridge or other test equipment shall not exceed ±2 percent. The test current through the specimen shall be as small as practical considering the sensitivity of the indicating instruments, unless the test current or voltage is specified. When it is important that the temperature of the specimen shall not rise appreciably during the measurement, the test voltage shall be applied uninterruptedly for as short a time as practicable, but in no case for more than 5 seconds, unless otherwise specified. The measurement shall be made at or corrected to 25°C.

3. SUMMARY. The following details are to be specified in the individual specification:

a. Limit of error of measuring apparatus, if other than one-tenth on specified tolerance (see 2).

b. Test voltage or current, if applicable (see 2).

c. Maximum period of uninterrupted test-voltage application, if other than 5 seconds (see 2).

METHOD 104

RESISTANCE-TEMPERATURE CHARACTERISTIC

1. PURPOSE. It is the purpose of this test to determine the percentage change in direct-current (dc) ohmic resistance from the dc ohmic resistance at the reference temperature, per unit temperature difference between the test temperature and the reference temperature. The equation (see 3) used to calculate this characteristic, commonly called the "temperature coefficient of resistance," is based on an assumed straight-line relationship between resistance and temperature over a range of specified test temperatures.

2. PROCEDURE.

2.1 Preparation. Test leads used to connect the specimens to the resistance-measuring devices shall be firmly fastened to the specimens. Precautions shall be taken to minimize errors in resistance measurement due to such factors as lead resistance, spurious electromotive forces, condensation of moisture, etc., throughout the range of test temperatures, by utilization of suitable test-lead materials and measurement techniques or by applying appropriate corrections.

2.2 Test temperatures. The reference temperature shall be 25°C or as specified. There shall be two standard series of test temperatures. The first series shall be 25°, 0°, -15°, and -55°C; the second series shall be 25°, 50°, 75°, 100°, 125°, 200°, 275°, and 350°C. The tolerance on each temperature in both series shall be ±3°C. The lowest test temperature in the first series, and the highest test temperature in the second series, shall be as specified. Measurements for each series of temperatures shall be performed in the order shown without interruption. However, a lapse of time not to exceed 24 hours is permitted between the end of the first series and the start of the second series.

2.3 Measurements. The resistance of each specimen shall be measured 30 to 45 minutes after the chamber temperature has become stable to within ±0.5°C at a test temperature. However, it will be permissible to measure the resistance before the end of this period if the resistance has become stable to within ±0.1 percent as determined by preliminary measurements made at 5-minute intervals after stabilization of the chamber temperature. Unless otherwise specified, the temperature at the time of measurement shall be measured to an accuracy of ±1 percent of the temperature difference between the nominal test temperature and the nominal reference temperature +0.5°C. Resistance measurements shall be made in accordance with method 103 of this standard.

3. RESULTS. The resistance-temperature characteristic, in percent change in resistance per degree centigrade, at each test temperature shall be computed as follows:

$$\text{Resistance-temperature characteristic} = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 100$$

Where:

R_1 = resistance at reference temperature (in same series as test temperature) in ohms.
R_2 = resistance at test temperature in ohms.
t_1 = reference temperature in degrees Celsius.
t_2 = test temperature in degrees Celsius.

4. SUMMARY. The following details are to be specified in the individual specification:

a. Reference temperature, if other than that specified (see 2.2).

b. Lowest and highest test temperature (see 2.2).

c. Accuracy of temperature measurement if other than that specified (see 2.3).

METHOD 105

FREQUENCY RESPONSE

1. PURPOSE. This test is to measure and record the frequency response characteristics of acoustical transducers (e.g. loudspeakers, earphones, microphones, etc).

2. TEST CONDITIONS.

2.1 Selection. In this method test condition letters are assigned relative to the type of acoustical transducer to be tested. The individual specification shall specify the "Test Condition" letter as appropriate.

Condition Letter	Type Element
A	Loudspeaker
B	Earphone
C	Microphone

3. PROCEDURES.

3.1 TEST CONDITION A. The loudspeaker shall be mounted and placed the specified distance from a calibrated Western Electric Type 640AA (or equal) condenser microphone and amplifier. The microphone shall be placed on the axis of the loudspeaker. The specified voltage shall be applied to the voice coil (either directly or indirectly as through required cords or cables, switches or transformers provided the voltage to the voice coil can be verified and is as specified). The frequency shall be varied continuously throughout the specified frequency range. 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 every 50 Hz from the lowest end of the frequency range to 600 Hz; every 100 Hz from 600 to 1,500 Hz; every 250 Hz from 1,500 Hz to 2,000 Hz; every 100 Hz from 2,000 to 2,500 Hz; every 250 Hz from 2,500 to 3,000 Hz; and every 500 Hz from 3,000 Hz to the top end of the frequency response range. The data shall be recorded and a graph drawn.

3.2 TEST CONDITION B. The earphone element shall be mounted as shown in the test circuit (see figure 105-1). Adjust the output from the audio oscillator to supply a specified power input to the element at 1,000 Hz as measured by the vacuum tube voltmeter (VTVM No. 1). The frequency of the input shall be varied continuously throughout the specified frequency range. 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. The output shall be recorded in the dB value above 0.0002 dynes per square centimeter. The writing speed and chart speed shall be noted. In lieu of this data recording method and at the option of the manufacturer, point-to-point measurements may be made every 100 Hz from the lowest end of the frequency range to 1,000 Hz; and every 250 Hz from 1,000 Hz to the top end of frequency range. These measurements shall be of the acoustic output from the calibrated microphone and preamplifier unit as indicated by the reading of VTVM No. 2 (see figure 105-1), and converted to the equivalent dB value above 0.0002 dynes per square centimeter, using the most recent available calibration curve for the test microphone. The data shall be recorded and a graph drawn.

3.3 TEST CONDITION C. The microphone shall be mounted on a 1/4" artificial voice (see figure 105-2) in such a way that the sound port is 0.25 inch from and coaxial with the opening in the artificial voice (this 0.25 inch measurement shall be to the microphone case, disregarding any moisture barrier). A signal shall be generated from the artificial voice such that the sound pressure level at the sound port shall be 103 dB SPL ±2 dB relative to 0.0002 dynes per square centimeter (20 micropascals). The frequency of the signal shall be varied continuously throughout the specified frequency range. The output of the microphone across a resistive load 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 every 50 Hz from the lowest end of the specified frequency range to 600 Hz; every 100 Hz from 600 to 1,500 Hz; every 250 Hz from 1,500 Hz to 2,000 Hz; every 100 Hz from 2,000 to 2,500 Hz; every 250 Hz from 2,500 to 3,000 Hz and every 500 Hz from 3,000 Hz to the top end of the specified frequency response range. The measurements shall be made with a Ballantine Electronic Voltmeter Model 300, or it's equivalent, having similar ballistics characteristics. The data shall be recorded and a graph drawn. Whichever method of measurement is used, the data shall be related back to 74 dB SPL re 0.0002 dynes per centimeter squared (20 micropascals).

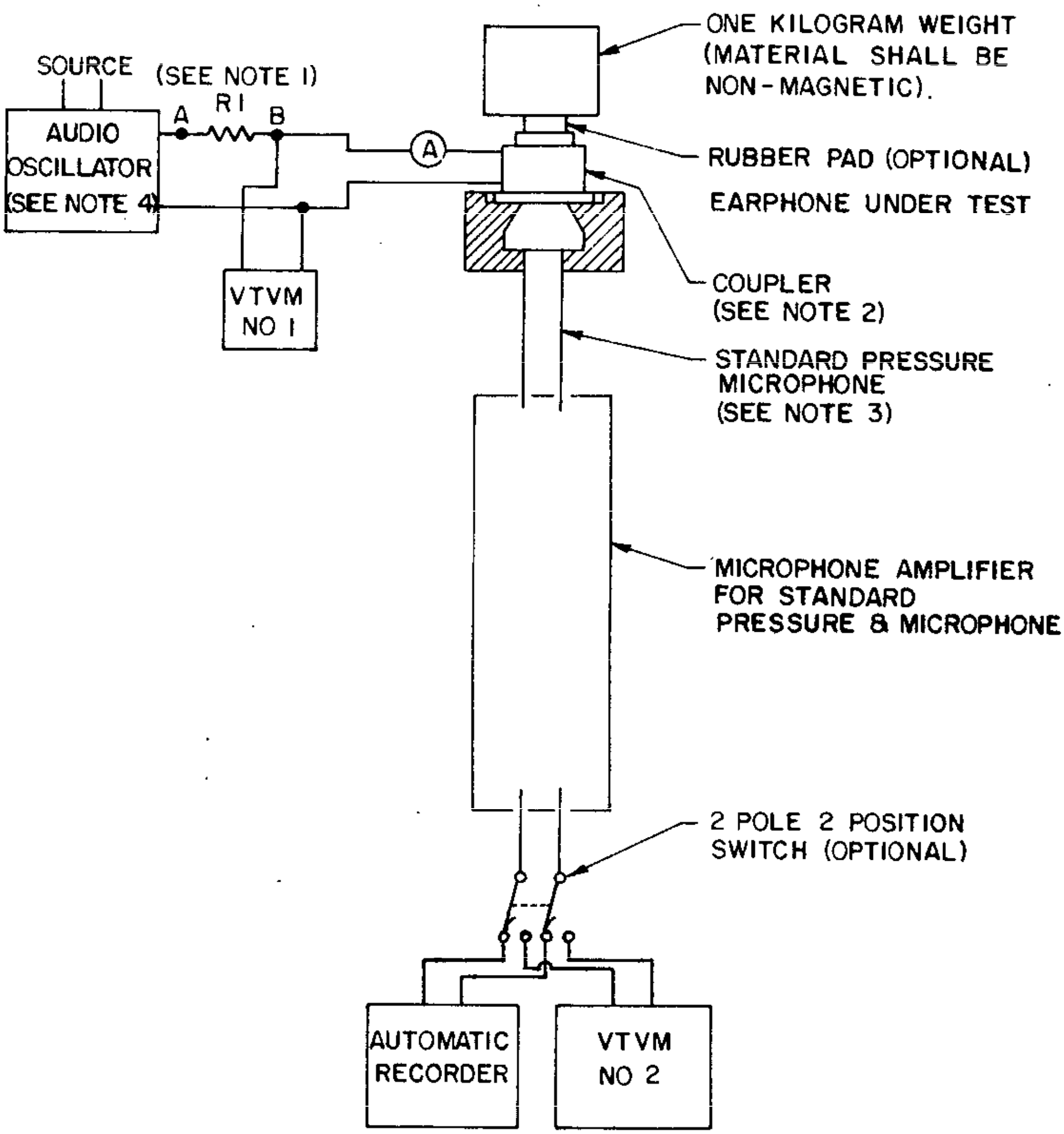
4. SUMMARY. The following details are to be specified in the individual specification.

a. Test condition letter.

b. Specified frequency range.

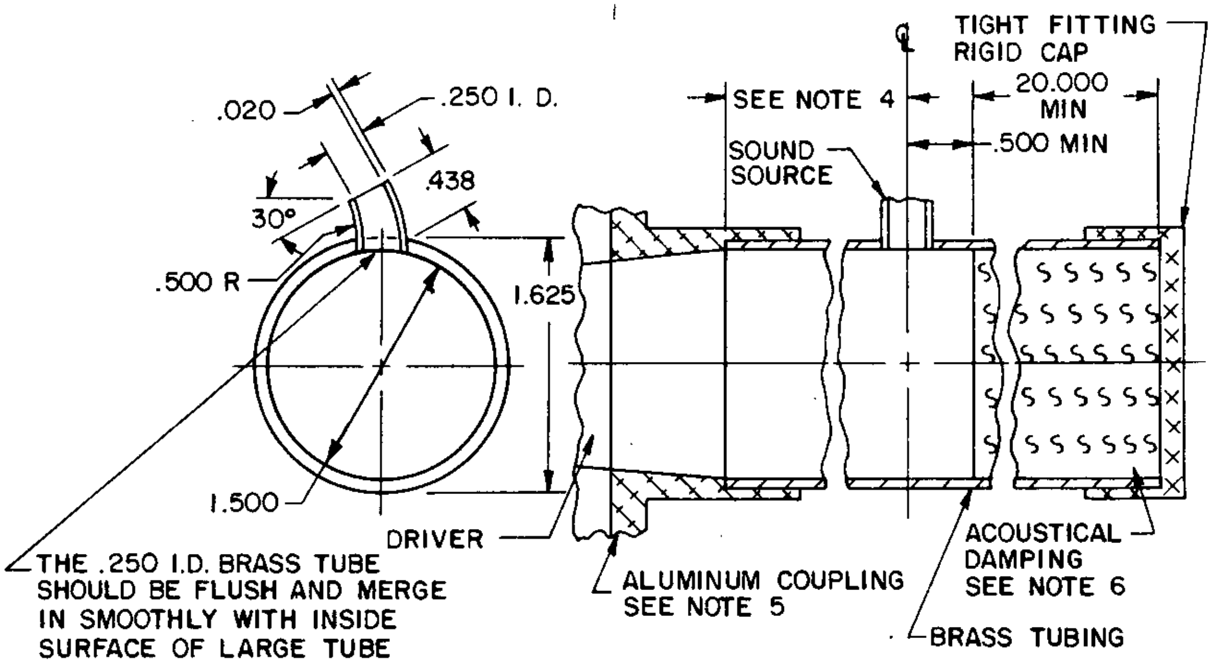
c. Resistive load.

d. Special conditions or precautions (as required).



NOTES:
1. R1 = Ohmic value of element under test.
2. Coupler in accordance with ANSI S3.7-1973, type 1.
3. Standard pressure microphone, in accordance with ANSI S1.12-1967.
4. Audio oscillator output shall be impedance matched for the circuit.
5. "Off" position on switches is optional.

FIGURE 105-1. Typical test circuit.



INCHES	MM
.020	.51
.250	6.35
.438	11.13
.500	12.70
1.500	38.10
1.625	41.28
20.000	508.00

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.
3. Unless otherwise specified, tolerance is ±.005 (.13 mm) and angles ±1/2°.
4. This dimension is non-critical and may be varied up to a length of one foot to suit the needs of the microphone mounting fixtures.
5. If the throat of the driver is unequal in diameter to the voice tube, a smooth transition shall be made so as to match properly the characteristic impedance of the tube to driver mechanism.
6. The end of the tube shall be filled evenly with an acoustical damping material, such as ozite, so as to provide a resistive termination equal to the charcteristic impedance of the tube. The damping material shall begin at a point not less than one half inch beyond the sound source orifice. The length of the damped portion of the tube shall be not less than 20 inches. Approximately 45 grams of ozite are required in a 20 inch length of tube.

FIGURE 105-2. Artificial voice (1/4 DIA). (Suggested configuration.)

METHOD 106

IMPEDANCE (RESISTIVE SUBSTITUTION)

1. PURPOSE. This test is to determine, measure and record the impedance characteristics of acoustical transducers (e.g. loudspeakers, earphones, microphones, etc.).

2. TEST CONDITIONS.

2.1 Selection. In this test method, test condition letters are assigned relative to the type of acoustical transducer to be tested. The individual specification shall specify the "Test Condition" letter as appropriate.

3. PROCEDURES.

3.1 TEST CONDITION A. The loudspeaker or earphone element shall be mounted and placed a specified distance from a calibrated Western Electric Type 640AA (or equal) condenser microphone and amplifier. The microphone shall be placed on the axis of the element under test. Through the use of the test configuration shown on figure 106-1, a 1 kHz signal shall be applied to the voice coil of the element under test. With switch S1 in the "B" position (shorting out R1) the output shall be measured on the VTVM. Then with S1 in the "A" position (not shorting out R1) the variable resistor R1 shall be adjusted until the output of the device under test is reduced by 6 dB. The variable resistor R1 shall then be removed from the circuit and measured on a standard resistive bridge. The ohmic value of the variable resistor shall be recorded as the impedance of the element under test.

3.2 TEST CONDITION B. The microphone shall be mounted on the test fixture (see figure 106-3) in a test circuit as in figure 106-2. The microphone shall be 0.25 inch from and coaxial with the opening in the artificial voice. Measurements shall be made with a sound pressure level of 103 dB SPL relative to 0.0002 dynes/cm^2 (20 micropascals). With the switch S1 in position "A" (variable resistor not in circuit), the output shall be measured on the VTVM. Then with switch S1 in position "B" (R1 in circuit), the variable resistor shall be adjusted until the output of the device under test is reduced by 6 dB. The variable resistor (R1) shall then be removed from the circuit and measured on a standard resistive bridge. The ohmic value of the variable resistor shall be recorded as the impedance of the device under test.

4. Summary. The following details shall be specified in the individual specifications.

   a. Test condition letter.

   b. Values of variable resistor.

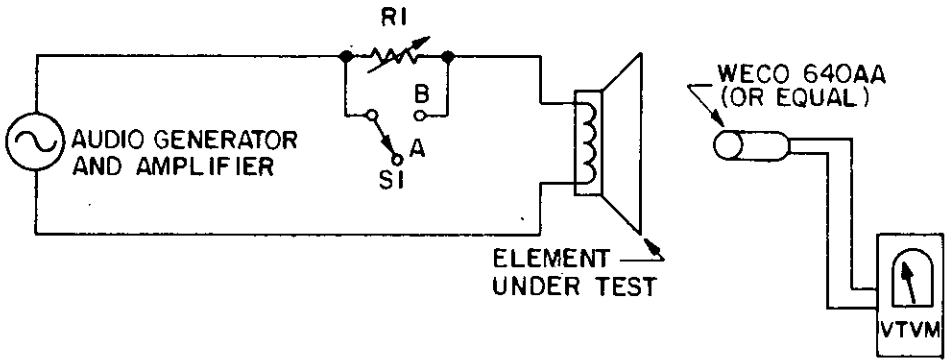


FIGURE 106-1. Impedance test circuit for loudspeaker and earphone type devices.

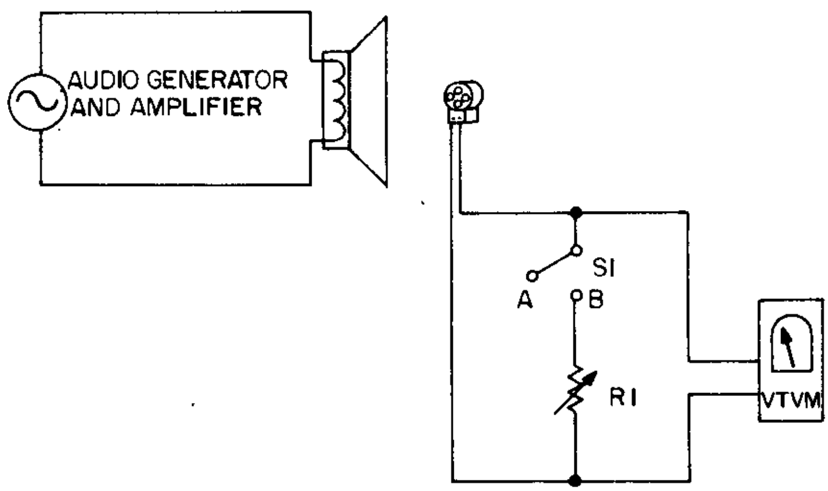
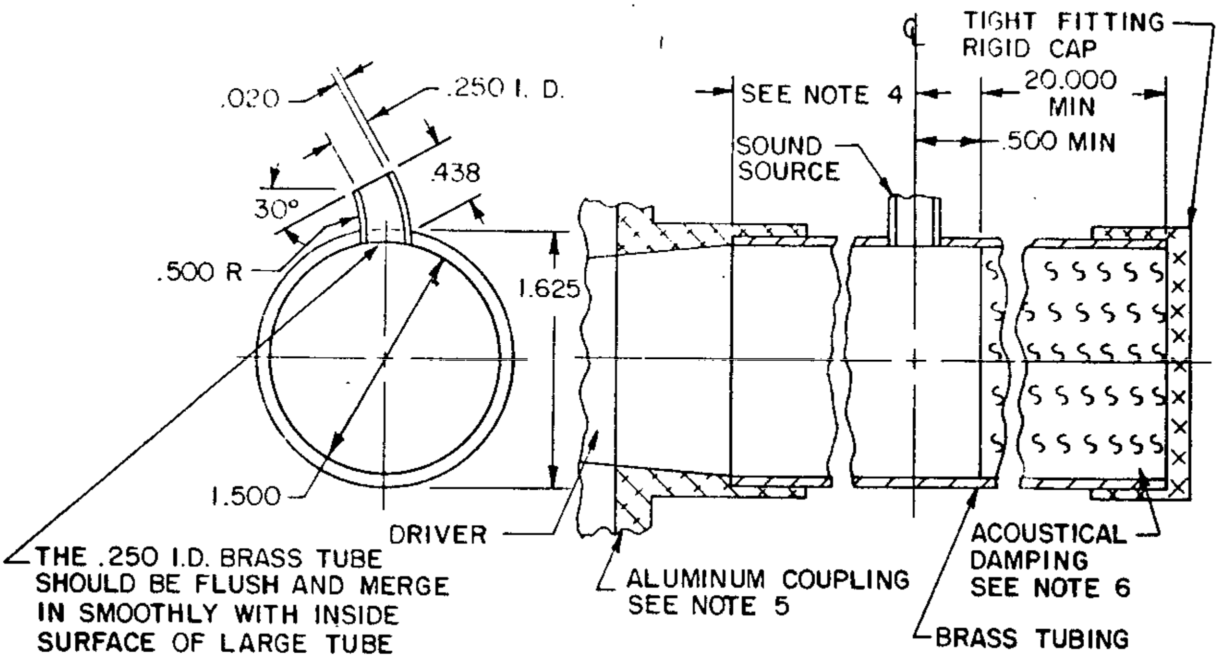


FIGURE 106-2. Impedance test circuit for microphone type devices.



INCHES	MM
.020	.51
.250	6.35
.438	11.13
.500	12.70
1.500	38.10
1.625	41.28
20.000	508.00

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.
3. Unless otherwise specified, tolerance is ±.005 (.13 mm) and angles ±1/2°.
4. This dimension is non-critical and may be varied up to a length of one foot to suit the needs of the microphone mounting fixtures.
5. If the throat of the driver is unequal in diameter to the voice tube, a smooth transition shall be made so as to match properly the characteristic impedance of the tube to driver mechanism.
6. The end of the tube shall be filled evenly with an acoustical damping material, such as ozite, so as to provide a resistive termination equal to the charcteristic impedance of the tube. The damping material shall begin at a point not less than one half inch beyond the sound source orifice. The length of the damped portion of the tube shall be not less than 20 inches. Approximately 45 grams of ozite are required in a 20 inch length of tube.

FIGURE 106-3. Artificial voice (1/4 DIA). (Suggested configuration.)

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