

MIL-C-18266A (AS)

30 June 1976

SUPERSEDING

MIL-C-18266 (AER)

1 NOVEMBER 1954

MILITARY SPECIFICATION

CORD: P/O H-87B/U

This specification is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers requirements and tests for Cord: P/O H-87B/U.

1.2 Classification. The cords covered by this specification shall be of one type, designated, Cord: P/O H-87B/U.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents, of the issue in effect on the date of invitation for bid or request for proposal, form a part of this specification.

SPECIFICATIONS

MILITARY

MIL-P-116	- Preservation, Methods of
MIL-P-642	- Plugs, Telephone And Accessory Screws
MIL-E-5400	- Electronic Equipment, Airborne, General Specification For
MIL-C-10392	- Cord, Electrical (Audio, Miniature)

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MIL-N-18307 - Nomenclature And Identification For Electronic, Aeronautical, And Aeronautical Support Equipment Including Ground Support Equipment

MIL-C-55442 - Cable Assemblies And Cord Assemblies, Packaging Of

STANDARDS

FEDERAL

FED-STD-228 - Cable And Wire, Insulated; Methods Of Testing

MILITARY

MIL-STD-105 - Sampling Procedures And Tables For Inspection By Attributes

MIL-STD-129 - Marking For Shipment And Storage

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

3. REQUIREMENTS

3.1 General. The requirements where applicable, including materials, processing and fabrication specified in MIL-E-5400 shall apply as requirements of this specification. Additional requirements shall be as specified herein.

3.2 Qualification. Cords furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.4).

3.3 Parts, materials and processes. Parts, materials and processes shall be as specified herein. However, when definite parts, materials and processes are not specified, parts, materials and processes shall be used which will enable the cord to meet all the requirements of this specification. Acceptance or approval of any constituent parts, materials and processes shall not be construed as a guarantee of the acceptance of the finished product.

3.3.1 Fungus and moisture resistant materials. Materials which are not nutrients for fungi and which are moisture resistant shall be used.

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3.3.1.1 Central cores, fillers, binders, etc. All cotton or other textiles used as a central core, filler, binder, etc. shall be fungus treated prior to their use. The impregnating material shall not affect the electrical or physical characteristics of the cordage.

3.3.2 Cordage. The insulation and jacket compounds shall be in accordance with MIL-C-10392 homogenous in character, tough and elastic. The resultant cordage shall be free from blisters, cracks and other imperfections which would affect its serviceability.

3.4 Design and construction.

3.4.1 Jacket. The jacket shall provide long life under severe service conditions. The jacket shall have a minimum thickness of 0.020 inch and shall not adhere or stick to the conductor insulation. The finished cordage shall have a reasonably smooth surface.

3.4.1.1 Stripping. Irregularities in the jacket edge due to stripping shall not exceed 3/16 inch overall.

3.4.2 Conductor. Each stranded conductor shall be equivalent to 404 circular mils (#24 AWG) and shall consist of 41 strands of #40 AWG bunched stranded with a lay of no more than 0.6 inch.

3.4.2.1 Conductor resistance. The resistance of the individual conductor of the finished cordage shall not exceed 0.04 ohm per foot at a temperature of 20° C.

3.4.2.2 Conductor strands. The conductor strands shall be 9.8 circular mils (#40 AWG) tinned cadmium-copper alloy having one percent nominal content of cadmium.

3.4.2.3 Conductor insulation. The conductor insulation shall be "free-stripping" and shall not have any detrimental properties which would make soldering of the conductors difficult. The conductor insulation shall be in accordance with MIL-C-10392.

3.4.3 Cordage assembly. The single conductor cordage shall be composed of a conductor in accordance with 3.4.2 and conductor insulation in accordance with 3.4.2.3. The multi-conductor cordage shall be Type WM-59A/U in accordance with MIL-C-10392.

3.4.3.1 Outside diameter. The cordage shall have a maximum outside diameter of 0.059 inch for single conductor and 0.212 ± 0.010 inch for multi-conductor.

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3.4.3.2 Electrical continuity. The electrical continuity shall be as shown schematically in Figure 1 and shall be tested in accordance with 4.7.2.

3.4.4 Tensile strength and elongation. The tensile strength and elongation of the conductor strands shall be tested in accordance with 4.6.5.

Tensile strength	45,000 psi min.
Elongation (in 10 inches)	13% min.

3.4.5 Dielectric strength. The finished cordage shall withstand without breakdown, a potential of 500 volts rms, 60 Hz applied for 1 minute when tested in accordance with 4.6.2.

3.4.6 Insulation resistance. The insulation resistance of the finished cordage shall be not less than 500 megohms per 1000 feet at a temperature of 20° C, when tested in accordance with 4.6.3.

3.4.7 Transformer dc insulation resistance. The dc insulation resistance between the primary and secondary windings within the transformer-plug shall be not less than 100 megohms at a temperature of 20° C, when tested in accordance with 4.7.3.

3.4.8 Stay cord. Where more than one conductor is required, a central core or interstice filler shall extend through the length of the cordage and shall be suitable for use as a strain-relief cord. The central core or filler shall be a low stretch material with a 25 pound minimum breaking strength. Where a single conductor is used, a stay cord will not be required, however, the conductor insulation shall be secured to the terminal by a suitable bond.

3.4.9 Flexing. The cordage shall be capable of withstanding at least 30,000 flexing cycles without showing evidence of electrical discontinuity or change in specified characteristics of the insulation when tested in accordance with 4.6.6.

3.4.10 Transformer-plug.

3.4.10.1 Transformer. The transformer shall be of the isolating impedance matching type capable of transferring audio frequency energy from a 600 ohm source (radio receiver output) to a 7.5 ohm load (two 15 ohm impedance earphones connected in parallel). The transformer shall provide a maximum power transfer of one-half watt with a power insertion loss not to exceed 2.5 dB and with no dc flowing in either primary or secondary winding.

3.4.10.2 Size. The size of the transformer shall be governed by the dimensions of the transformer-plug shell.

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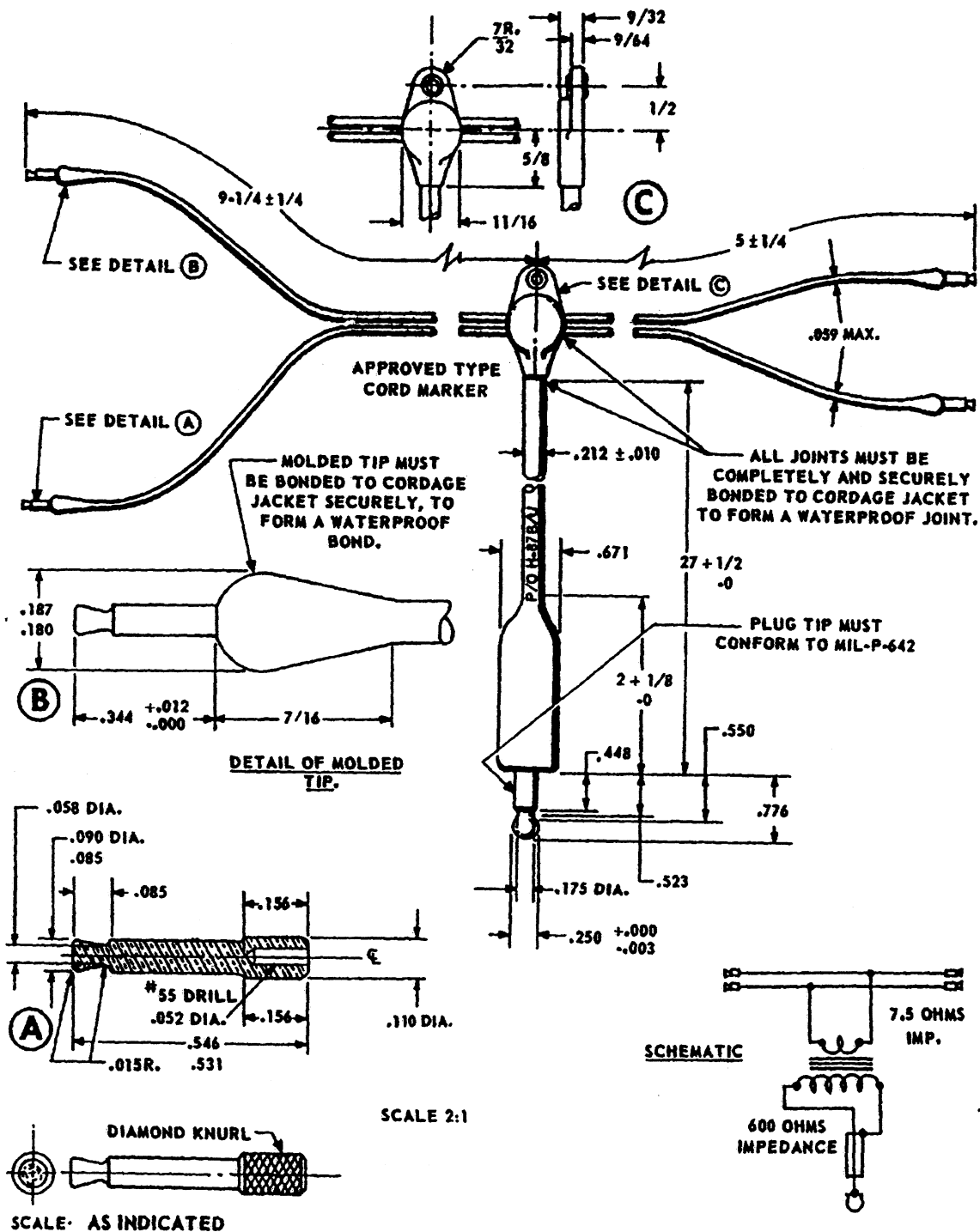


Figure 1. Cord, P/O H-87/U

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3.4.10.3 Plug. The plug shall be in accordance with MIL-P-642 for Type PJ-054 except that the shell and terminals may be modified to accommodate the transformer. The shell shall be an integral part of the plug sleeve and shall provide means for anchoring the cordage.

3.4.10.4 Terminals. The terminals shall be of the "slim type" made of half-hard brass and finished with white nickel plate to 0.0004 inch minimum depth. The finished dimensions shall be as given in Figure 1.

3.4.11 Cord assembly. Cord: P/O H-87B/U shall be assembled as shown pictorially and schematically in Figure 1. After assembling the transformer within the transformer-plug shell, the remaining space within the shell shall be filled with a suitable epoxy resin. The assembled transformer-plug shall be protected by rubber molding to a depth of not less than 0.025 inch. The junction of the single and multi-conductor cordage shall be protected and reinforced by a rubber molding. In addition, the junction molding shall include an eyelet for attaching the cord to the helmet. The dimensions of the finished cord shall be in accordance with Figure 1.

3.4.12 Total weight. The total weight of each cord shall be no greater than six ounces.

3.5 Performance.

3.5.1 Frequency response. The frequency response characteristics of the transformer shall be smooth and free from abnormal irregularities over the frequency range of 200 to 6000 Hz. The output response over this frequency range shall be within ± 2 dB of the 1000 Hz output when tested in accordance with 4.7.4.

3.5.2 Distortion. The distortion introduced by the transformer shall not exceed 2 percent for frequencies between 1000 and 6000 Hz. The distortion may increase for frequencies below 1000 Hz but shall not exceed 15 percent at 200 Hz when tested in accordance with 4.7.5.

3.5.3 Impedance. The impedance of the primary and secondary windings over the frequency range of 200 to 6000 Hz shall not deviate from the 1000 Hz values by more than 15 percent when tested in accordance with 4.7.6.

3.5.4 Overload. The cord (transformer) shall be able to withstand an overload of 500 milliwatts rms at 1000 Hz for a period of 8 hours without signs of failure when tested in accordance with 4.7.7. After meeting this requirement, the cord (transformer) shall meet the requirements of 3.5.1 and 3.5.2.

3.6 Environmental.

3.6.1 Flame-retardance. Self-sustained combustion to the insulation of the finished cord shall not progress at a rate in excess of 1 inch per minute when tested in accordance with 4.6.4.

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3.6.2 Temperature requirements.

3.6.2.1 Operating range. The cordage shall be flexible and resilient throughout the temperature range of -55 to +85° C.

3.6.3 Humidity. The cord shall be able to withstand an ambient humidity condition of 95 percent relative at 50 degrees C (122° F). After meeting this requirement, the cord shall meet the requirements of 3.5.1.

3.6.4 Cold bend. Specimens of the cordage shall show no evidence of cracking or other damage to the jacket or conductor insulation after being subjected to a cold bend test in accordance with 4.6.7. Immediately following the cold bend test, the specimens shall withstand, while immersed in tap water, a potential of 500 volts rms, 60 Hz applied between each conductor and the water for 1 minute.

3.6.5 Ambient temperature cycling. The cord shall be able to withstand ambient temperature cycling without degradation of performance when tested in accordance with 4.7.9. After meeting this requirement, the cord shall meet the requirements of 3.5.1.

3.7 Identification.

3.7.1 Nomenclature. The nomenclature shall be in accordance with MIL-N-18307.

3.7.1.1 Cord. The complete cord shall have a metal band or other suitable means of marking to show the designation P/O H-87B/U, contract number, and contractor's code designation in conformance with MIL-N-18307 and as shown in Figure 1.

3.8 Workmanship. Workmanship shall conform to MIL-E-5400.

4. QUALITY ASSURANCE PROVISIONS

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

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

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1. Qualification inspection (see 4.3)
2. Quality conformance inspection (see 4.4)

4.3 Qualification inspection. Qualification inspection shall consist of all the requirements and tests of Table I and of this specification performed at a laboratory approved by the qualifying activity.

4.3.1 Qualification samples. Qualification samples shall consist of ten complete cords of each manufacturer's part number upon which approval is requested. In lieu of ten completed cords, the manufacturer may with the approval of the qualifying activity, submit five complete cords and five cords complete except for the transformer-plug. The samples submitted for qualification approval shall be representative of normal production.

4.3.1.1 Scope. The qualification inspection shall consist of tests in the following categories:

1. Tests to determine the suitability of the cordage.
2. Tests to determine the suitability of the finished product (cord).

4.3.2 Retention of qualification. Retention of qualification shall be made by means of certification (DD Form 1718, Certification of Qualified Products, shall be used for obtaining certification). Failure to provide certification shall be cause for removal from QPL.

4.4 Quality conformance inspection. The contractor shall furnish all samples and shall be responsible for performing the required tests. All inspection and testing shall be under the supervision of the Government inspector. The contractor shall furnish test reports, in duplicate, showing quantitative results for all acceptance tests. Such reports shall be signed by an authorized representative of the contractor or laboratory. Quality conformance shall consist of the following tests:

Individual tests (see 4.4.1)

Sampling tests (see 4.4.2)

4.4.1 Individual tests. Each cord shall be subjected to the tests specified under Qualification and Quality Conformance Inspection, "Individual" of Table I.

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TABLE 1. Qualification and quality conformance inspection.

Tests	Requirement paragraph	Test paragraph	Qualification	Quality conformance inspection	
				Individual	Sampling
Visual inspection	3.1, 3.4.11, 3.4.12, 3.7, 3.8	4.7.1	X	X	
Electrical continuity	3.4.3.2	4.7.2	X	X	
Transformer dc insulation resistance	3.4.7	4.7.3	X		
Frequency response	3.5.1	4.7.4	X		X
Distortion	3.5.2	4.7.5	X		X
Impedance	3.5.3	4.7.6	X		X
Overload	3.5.4	4.7.7	X		
Humidity	3.6.3	4.7.8	X		
Ambient temperature cycling	3.6.5	4.7.9	X		
Visual inspection	3.1, 3.3, 3.4 thru 3.4.3.1, 3.4.8, 3.4.10, 3.8	4.6.1	X		
Dielectric strength	3.4.5	4.6.2	X		
Insulation resistance	3.4.6	4.6.3	X		
Flame retardance	3.6.1	4.6.4	X		
Tensile strength and elongation	3.4.4	4.6.5	X		
Flexing	3.4.9	4.6.6	X		
Cold bend	3.6.4	4.6.7	X		

4.4.2 Sampling. Sampling and inspection shall be in accordance with MIL-STD-105, inspection level S-2. The acceptable quality level (AQL) shall be 1.0.

4.5 Test conditions. Unless otherwise specified, all tests specified herein shall be made under the following ambient conditions:

1. Temperature: From plus 20 to plus 35 degrees C.
2. Pressure: From 28 to 30 inches of mercury.
3. Humidity: From 15 to 90 percent relative.

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4.5.1 Tolerances. Where specific tolerances are not given, the maximum allowable tolerances on test condition measurements shall be as follows:

1. Temperature: ± 2 degrees C.
2. Humidity: ± 5 percent relative.

4.5.2 Test equipments. All instruments used in performing the tests required by this specification shall meet at least one of the following requirements:

4.5.2.1 Navy standard. Shall be listed as approved standard Navy test equipments.

4.5.2.2 Specific approval. Shall be acceptable to the cognizant Government Inspector and the Procuring Activity as indicated by written approval on file at the contractor's plant.

4.5.2.3 Audio Oscillator. The audio oscillator shall have a frequency range of at least 100 to 10,000 Hz, shall have a high degree of stability in both output voltage and frequency and shall have a waveform distortion of less than 2 percent, (the General Radio Company Type 913-C, Hewlett-Packard Type 205-AG or equal are recommended).

4.5.2.4 Voltmeter. The voltmeters used shall have flat frequency response (± 1 dB) from at least 100 to 10,000 Hz, and shall be capable of measuring voltages from .005 volt rms to 100 volts rms (Ballantine Laboratories Inc. Model 300, Hewlett-Packard Model 400A or equal are recommended).

4.5.2.5 Distortion analyzer. The distortion analyzer shall be of the wave analyzer or total distortion type. The frequency range shall be at least 100 to 10,000 Hz with high selectivity and an input voltage range from .001 to 10 volts. (The General Radio Type 736-A, Hewlett Packard Type 330-B or equal are recommended).

4.6 Cordage test methods.

4.6.1 Visual inspection. The visual inspection shall be an examination of the cordage to determine that the materials, physical dimensions and method of construction are as specified and that the workmanship is satisfactory.

4.6.1.1 Construction. The diameter, thickness of the conductor insulation and jacket of the cordage shall be measured by means of a measuring microscope or other gage accurate to 0.001 inch and capable of being operated in such a way as not to deform the insulation significantly.

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4.6.1.2 Stripping. Irregularities in the jacket edge due to stripping shall not exceed 3/16 inch overall.

4.6.2 Dielectric strength. The finished cordage shall be immersed in tap water at room temperature for 24 hours with the end terminals entirely above the surface of the water. At the end of this period, the specified voltage shall be applied between the two conductors, and between each of the two conductors and the water in which the cordage is immersed.

4.6.3 Insulation resistance. The insulation resistance shall be measured immediately following the Dielectric Strength Test with a suitable resistance measuring device, using a 500-volt dc potential. The conductors shall be maintained negative with respect to the ground. The insulation resistance shall be determined one minute after voltage application, or sooner if the reading of the resistance measuring device remains steady.

4.6.4 Flame - retardance. The flame-retardance test shall be performed with the test sample mounted horizontally.

4.6.5 Tensile strength and elongation. The tensile strength and elongation of the coated conductor strands, removed from the insulated conductor prior to cabling, shall be tested in accordance with FED-STD-228, Method 3211.

4.6.6 Flexing. The flexing tests shall be conducted in accordance with MIL-C-10392.

4.6.7 Cold bend. The cold bend test shall be conducted in accordance with MIL-C-10392.

4.7 Cord test methods.

4.7.1 Visual inspection. Each cord shall be visually inspected to insure that:

1. All external surfaces, including any plated parts, are free from blemishes which would permit breaking of the protective coating.
2. All moldings are free of wrinkles, excessive flash and fins.
3. All markings are complete and in accordance with an approved sample or Figure 1.
4. The weight and all overall dimensions are correct by comparison with an approved sample or Figure 1.

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4.7.2 Electrical continuity. Each conductor shall be checked for electrical continuity with a circuit checker, ohmmeter or similar instrument.

4.7.3 Transformer dc insulation resistance. The insulation resistance between the primary and secondary windings within the transformer-plug shall be measured between the tip or sleeve and the earphone terminals using any standard meg-ohmmeter circuit which is designed to apply at least 500 volts dc across the test terminals during the measurement.

4.7.4 Frequency response. The frequency response of the transformer within the cord shall be measured as follows:

1. Connect the tip and sleeve of the plug across the 600 ohms output terminals of the audio oscillator. In the event the audio oscillator has no 600 ohm terminals, an impedance matching device may be used provided there is sufficient output to overcome the loss.
2. Connect a 15 ohm ± 2 percent 1-watt resistor across each pair of earphone terminals.
3. Adjust the output from the audio oscillator to give 1.9 volts rms at 1000 Hz as measured by a voltmeter at either pair of earphone terminals.
4. Maintain the audio oscillator output established for the 1000 Hz reading and repeat the measurement for each of the following frequencies:
 - a. From 200 to 1000 Hz inclusive - measure at each increment of 100 Hz.
 - b. From 1250 to 7000 Hz inclusive - measure at each increment of 250 Hz.

4.7.5 Distortion. The distortion introduced by the transformer in the cord shall be determined as follows:

1. Connect the cord under test, audio oscillator and voltmeter outlined in 4.7.4 (1), (2) and (3).
2. Connect the distortion analyzer input in parallel with the voltmeter.
3. Measure the distortion introduced by the transformer for an output of 1.9 volts rms at 1000 Hz.

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4. Maintain the audio oscillator output established for the 1000 Hz reading and repeat the distortion measurements for each of the following frequencies:
 - a. From 200 to 1000 Hz inclusive - measure at each increment of 200 Hz.
 - b. From 2000 to 7000 Hz inclusive - measure at each increment of 1000 Hz.

4.7.6 Impedance. The impedance shall be measured at frequencies selected as necessary to insure that the requirements of 3.5.3 are met. The voltmeter-ammeter method of measurement or other method satisfactory to the cognizant Government Inspector shall be used. The voltage applied across the terminals during impedance measurements should be approximately the same as applied under maximum output conditions. When the impedance of the primary is measured, the secondary shall be terminated by a 7.5 ohm resistor and for the secondary measurement, the primary shall be terminated by a 600 ohm resistor.

4.7.7 Overload. Audio power of 500 milliwatts rms at 1000 Hz shall be applied through the cord (transformer) to a dummy load for a period of 8 hours. During the last hour of the test, the cord (transformer) shall be checked for signs of failure. Upon completion of the overload test, the frequency response and distortion characteristics shall be measured as specified in 4.7.4 and 4.7.5.

4.7.8 Humidity. Each cord under test shall be subjected to an ambient humidity condition of 95 percent relative at 50 degrees C (122 degrees F) for a total of 144 hours. At the end of this period the frequency response measurement shall be as specified in 4.7.4.

4.7.9 Ambient temperature cycling. Ambient temperature cycling shall consist of varying the ambient temperature surrounding the cord under test as follows:

1. Reduce the ambient temperature from normal room temperature to -62 degrees C as rapidly as practicable.
2. Retain the ambient temperature at minus 62 degrees C for 30 minutes.
3. Increase the ambient temperature to plus 85 degrees C as rapidly as practicable.
4. Retain the ambient temperature at plus 85 degrees C for 30 minutes.

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5. Reduce the ambient temperature to normal room temperature as rapidly as practicable.
6. Retain the ambient temperature at normal room temperature for 10 minutes.
7. Repeat the procedures set forth in paragraphs (1) to (6) above inclusive, until the cord has been subjected to 5 complete cycles.
8. Upon completion of the last of 5 temperature cycles, retain the ambient temperature at normal room temperature for one hour, then measure the frequency response as specified in 4.7.4.

4.7.10 Packaging inspection. Packaging quality conformance inspection shall meet the requirements of MIL-P-116.

5. PACKAGING

5.1 All major units and parts of the equipment shall be packaged and packed for shipment in accordance with levels A, B or Commercial requirements of MIL-C-55442 as specified (see 6.2) and marking shall be in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. The cord covered by this specification shall be designed to provide electrical connections between earphones H-87B/U and inter-communication and/or radio facilities.

6.2 Ordering data. Procurement documents should specify the following:

6.2.1 Procurement requirements.

1. Title, number, and date of this specification.
2. Levels of packaging and packing as specified in the contract or order.

6.2.2 Contract data requirements. Data specified in paragraph 4.4 will be listed directly on a DD Form 1423 incorporated into the contract.

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6.3 Definitions.

6.3.1 Cordage and cord. The term "cordage" as used in this specification means Cord, Electrical while "cord" means Cord Assembly, Electrical.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged 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. The activity responsible for the Qualified Products List is Commander, Naval Air Systems Command, Code: AIR-53343B, Department of the Navy, Washington, DC 20361, however, information pertaining to qualification of products may be obtained from Commanding Officer, Naval Weapons Support Center (3072), Crane, IN 47522.

6.5 Details of construction. This specification is not intended to be restrictive with respect to details of construction, except where such details are specified. Alternate forms of construction will be considered provided the contractor submits to the Procuring Activity for approval a clear description of the points of difference and data to show that all the performance requirements of this specification are being met.

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

Preparing Activity
Navy - AS
(Project No. 5965-N144)

