

INCH-POUND

MIL-C-5756C
 5 April 1990
~~SUPERSEDING~~
 MIL-C-5756B(ASG)
 8 October 1954

MILITARY SPECIFICATION

CABLE, POWER, ELECTRICAL, PORTABLE
 GENERAL SPECIFICATION FOR

This specification has been approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers 600-volt heavy duty, portable, power, single and multiconductor, electrical cable for severe flexing service.

1.2 Classification. Cable of this specification shall be in accordance with the applicable specification sheet (see 3.1).

1.3 Part number. Part numbers defined in this specification are coded as in the following example:

M5756	/2	-001
Basic Specification	Applicable Specification Sheet	Dash Number

Example: M5756/2-001. The cable is produced in accordance with part number M5756/2-001 from MIL-C-5756.

1.3.1 Basic specification. The basic specification shall describe the performance requirements of components and finished cable.

1.3.2 Applicable specification sheet. The specification sheet shall describe the material and construction details of finished cable and components.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 53), Naval Air Engineering Center, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be 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).

SPECIFICATIONS

Federal

NN-P-530	Plywood, Flat Panel
O-C-265	Chemical, Analytical, General Specification for
PPP-B-621	Boxes, Wood, Nailed and Lock Corner
QQ-W-343	Wire, Electric, Uninsulated
TT-I-735	Isopropyl Alcohol
TT-S-735	Standard Test Fluids, Hydrocarbon

Military

MIL-L-6082	Lubricating Oil, Aircraft Reciprocating Engine (Piston)
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STANDARDS

Federal

FED-STD-228	Cable and Wire, Insulated, Methods of Testing
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Military

MIL-STD-104	Limits for Electrical Insulation Color
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-970	Standards and Specifications, Order of Precedence for the Selection of
MIL-STD-45662	Calibration Systems Requirements

Supplement - See Supplement 1 for list of applicable specification sheets.

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Naval Publications and Forms Center, Attn: NPODS, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

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2.1.2 Other Government documents. The following other Government document forms a part of this specification to the extent specified herein. Unless otherwise specified, the issue shall be the one in effect on the date of the solicitation.

DEFENSE LOGISTICS AGENCY

H4/H8

Catalog of Commercial and Government Entities (CAGE)

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

2.2 Non-Government publications. The following documents form a part of this specification 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/ASME B46.1 Surface Texture

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM A686	Tool Steel, Carbon and Carbon-Vanadium
ASTM D1149	Accelerated Ozone Cracking of Vulcanized Rubber, Test for
ASTM B3	Standard Specification for Soft or Annealed Copper Wire
ASTM B33	Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes
ASTM B172	Rope-Lay-Stranded Copper Conductors Having Bunched Members, for Electrical Conductors
ASTM B174	Bunch-Stranded Copper Conductors for Electrical Conductors
ASTM D3599	Kerosene

(Application for copies of ANSI standards should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018. Application for copies of ASTM standards should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

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2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, 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 requirements for the component wire and finished cable furnished under this specification shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern (see 6.2).

3.2 Qualification. The finished cables furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.3 and 6.3).

3.3 Materials. Materials used in the manufacture of the cable shall be of high quality suitable for the purpose and conforming with Government specifications cited.

3.3.1 Conductor materials. All strands used in fabricating the conductors of this specification shall be annealed copper strands 0.0063 nominal inch in diameter (AWG 34) conforming to ASTM B3 or ASTM B33 and shall be uncoated or tin-coated as specified in 3.3.1.1 or 3.3.1.2. Strands shall be free of lumps, kinks, splits, scraped or corroded surfaces and skin impurities.

3.3.1.1 Bare copper strands. Bare (uncoated) copper strands shall be used for conductors of size 8 and larger. The bare copper strands shall be in accordance with ASTM B3.

3.3.1.2 Tin coated copper strands. Individual copper strands shall be uniformly coated with commercially pure tin for conductors size 10 and smaller. The tin coated copper strands shall be in accordance with ASTM B33.

3.3.2 Insulation and jacket materials. Materials for wires and cables shall be in accordance with the applicable specification sheet and shall be capable of meeting all requirements of this specification. Materials shall be designed to be resistant to degradation by ozone and weathering through use of ozone and weathering resistant materials or protectants unless otherwise specified in the specification sheet.

3.3.3 Selection of materials. Specifications and standards for all materials, parts and Government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification shall be selected in accordance with MIL-STD-970 and the applicable specification sheet.

3.4 Design and construction. Wire and cable shall be of the design, construction and physical dimensions specified herein and in the applicable specification sheet.

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3.4.1 Conductors. Stranded conductors shall be annealed copper wire in accordance with QQ-W-343, Temper 1 and coating B or T as specified. Conductors of size 18-14 shall be Type B, Class M, of QQ-W-343. Conductors of size 10-250 shall be Type R, Class L, of QQ-W-343. All conductors shall conform to the requirements of Table I of this specification unless otherwise required by the specification sheet.

TABLE I. Requirements for conductors.

Wire size (AWG)	Minimum no. of AWG 34 strands	Lay-Up of strands	Minimum conductor diameter (inches)	Nominal conductor diameter (inches 1/)	Maximum conductor diameter (inches)
18	41	1 x 41	0.046	0.048	0.050
16	65	1 x 65	0.057	0.060	0.063
14	104	1 x 104	0.074	0.078	0.082
12	165	1 x 165	0.095	0.101	0.106
10	259	7 x 37	0.120	0.126	0.132
8	420	7 x 60	0.154	0.162	0.170
6	665	19 x 35	0.204	0.215	0.226
4	1064	19 x 56	0.256	0.269	0.282
2	1666	7 x 7 x 34	0.320	0.337	0.354
1	2107	7 x 7 x 43	0.357	0.376	0.395
1/0	2646	7 x 7 x 54	0.402	0.423	0.444
2/0	3325	19 x 7 x 25	0.483	0.508	0.533
3/0	4256	19 x 7 x 32	0.547	0.576	0.605
4/0	5320	19 x 7 x 40	0.613	0.645	0.677
250 kcmil	6384	19 x 7 x 48	0.655	0.690	0.725

1/ Nominal values are given for information only.

3.4.1.2 Conductor splices. Splices of individual strands or of individual rope lay members are permitted and shall be a butt joint. No more than one joint shall be at the same conductor cross-section and in no case shall an entire conductor be spliced at one point.

3.4.1.3 Lay length of stranded conductors. The lay length of bunch stranded conductors (size 12-18) shall be in accordance with ASTM B174. The lay length of rope-lay stranded conductors having bunched stranded members (size 10-250) shall be in accordance with ASTM B172.

3.4.2 Separator. When bare (uncoated) conductors are used, a separator of suitable material shall be applied between the conductor and the insulation. When tin-coated conductors are used, application of such a separator is optional with the manufacturer. The inner wrap of suitable threads or tapes shall form a close fit over the conductor in such manner that when stripped the conductor is clean and in condition for electrical contact.

3.4.3 Insulation thickness. The minimum thickness of insulation over each stranded conductor shall be as specified in the applicable specification sheet (see 4.5.10).

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3.4.4 Cabling and application of filler. For cables consisting of more than one insulated conductor, the separately insulated conductors shall be cabled together with a left-hand lay and, where necessary, the interstices filled to give the cable a substantially circular cross section. The length of the lay of the conductors shall not exceed 16 times the calculated diameter under the jacket based on specified nominal dimensions. Material used for filler shall be compatible with the requirements of the finished cable.

3.4.5 Jacket thickness. The minimum jacket thickness shall be in accordance with Table II unless otherwise specified in the applicable specification sheet (see 4.5.11).

TABLE II. Jacket thickness, shock and abrasion requirements.

Diameter under jacket (inches)	Minimum jacket thickness (inches)	Nominal jacket thickness 1/ (inches)	Abrasion test weight (pounds)	Impact (shock) test (min. no. of impacts) and abrasion test (min. no. of oscillations)
0.325 and less	0.056	0.0625	2	600
0.326 to 0.430	0.070	0.078	2	800
0.431 to 0.540	0.085	0.094	2	900
0.541 to 0.640	0.098	0.109	3	1000
0.641 to 0.740	0.113	0.125	3	1200
0.741 to 0.850	0.127	0.141	3	1400
0.851 to 1.100	0.140	0.156	6	1550
1.101 to 1.320	0.155	0.172	6	1700
1.321 to 1.550	0.168	0.187	6	1850
1.551 to 1.820	0.182	0.203	6	2000

1/ Nominal values are given for information only.

3.4.6 Color coding. Cable consisting of two or more conductors shall have the insulation of individual conductors colored as specified herein unless otherwise specified in the applicable specification sheet. The color limits shall be in accordance with MIL-STD-104, Class 2. The conductors shall be cabled together in the color sequence shown below. Unless otherwise specified the insulation of the center conductor shall be colored black.

<u>Conductor number</u>	<u>Conductor insulation color</u>
1	Black
2	White
3	Red
4	Green
5	Orange
6	Brown
7	Blue

Example: A 3-conductor cable will contain 1 black, 1 white and 1 red colored insulated wire.

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3.5 Performance. The cables shall be capable of meeting all the requirements of this specification when tested using the test methods of Section 4.

3.5.1 Spark (insulation flaws). Prior to assembling into the finished cable, each insulated conductor shall withstand a 3000 +100 volt spark test to assure there are no electrical defects in the insulation. Any portions of the insulated conductor nor withstanding the voltage shall be removed (see 4.5.2.1).

3.5.2 High potential (wet dielectric). All finished cable shall withstand a minimum 3000 +100 volt AC dielectric voltage between each conductor and the water. Rupture or puncture of the insulation shall constitute failure (see 4.5.2.2).

3.5.3 High temperature. The cable shall withstand the dielectric requirement of 3.5.7 and 70 percent of the minimum number of abrasion resistance oscillations of Table II after the high-temperature test (see 4.5.3).

3.5.4 Impact (shock). The cable shall withstand a minimum number of impact shocks listed in Table II after the heat conditioning portion of the test. Failure of a specimen shall be when current ceases to flow or when the specimen shorts out or grounds (see 4.5.4).

3.5.5 Abrasion. Cable shall withstand the minimum number of oscillations listed in Table II using the applicable weights from Table II (see 4.5.5).

3.5.6 Fluid immersion. The cable shall not increase in diameter more than 15 percent, shall meet the dielectric requirement of 3.5.7, and shall meet 70 percent of the minimum number of abrasion resistance oscillations of Table II after the fluid immersions (see 4.5.6).

3.5.7 Dielectric. The cable shall withstand the applicable test voltage while immersed in water. There shall be no rupture or puncture of the insulation (see 4.5.7).

3.5.8 Insulation resistance. The cable shall have an insulation resistance of not less than the value of R calculated from the following formula:

$$R = k \log D/d$$

where:

D = diameter over the insulation (inches)
 d = diameter under the insulation (inches)
 R = insulation resistance (megohms per 1000 ft at 60°F)
 k = 2000 unless otherwise specified (see 4.5.8)

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3.5.9 Low temperature.

3.5.9.1 Cold bend. The insulation or cable jacket shall not crack during the test and must meet the dielectric requirement of 3.5.7 after the test (see 4.5.9.1).

3.5.9.2 Cold impact. The insulation or cable jacket shall not fracture during the test and must meet the dielectric requirement of 3.5.7 after the test (see 4.5.9.2).

3.5.10 Ozone resistance. Heat aged and unaged specimens of the cable jacket and the wire insulation of each color shall exhibit no cracks when examined under a seven power optical magnifier after ozone exposure (see 4.5.12).

3.5.11 Conductor resistance. The maximum direct current conductor resistance shall not exceed that shown in the applicable specification sheet (see 4.5.13).

3.5.12 Bending endurance. Finished cable shall exhibit no electrical breakdowns or cracking of the outer jacket during or after the test. There shall be no conductor breakage or a short circuit due to shorts between the insulated conductors (see 4.5.14).

3.6 Identification of product. All cable manufactured in accordance with this specification shall be identified by surface printing. Single conductor cables size 8 and larger and all multiconductor cables shall have a marker tape approximately 1/8 inch wide placed under the jacket or insulation in addition to the surface printing. Printing on the surface and the marker tape, when applicable, shall be at intervals of less than 18 inches, as measured from the start of one complete marking to the beginning of the next. The following information shall appear on the cable surface and the marker tape, when applicable:

"Military specification part number of the cable" (see 1.3)

"The manufacturer's Commercial and Government Entity (CAGE) designation in accordance with publication H4/H8"

"The year of manufacture of the cable"

An example would be:

M5756/2-001 12345 1988

At the manufacturer's option, the company name or logo may also be printed on the jacket, insulation or the marker tape of the cable.

3.6.1 Use of MIL designations. MIL designations shall not be applied to a product, except for Qualification test samples, nor referred to in correspondence until notice of approval has been received from the qualifying activity.

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3.7 Workmanship. Cables shall be constructed and finished in a thoroughly workmanlike manner in accordance with accepted high grade production techniques. The cables shall be a uniform and consistent product and shall be free from any defects which will adversely affect the serviceability of the product, such as lumps, kinks, splits, abrasions, scrapes, corroded surfaces, skin impurities and faulty extruded surfaces.

4. QUALITY ASSURANCE PROVISIONS

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

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements; however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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

- a. Qualification inspection (see 4.3)
- b. Quality conformance inspection (see 4.4)
 - 1. Individual tests (see 4.4.2)
 - 2. Sampling plan tests (see 4.4.3)
- c. Retention of qualification (see 4.3.1)

4.2 Inspection condition. Unless otherwise specified, all inspections shall be made under the following room conditions:

Temperature	20-30°C (68-86°F)
Relative humidity	30-80%
Air pressure	600-800 millimeters mercury (23.62-31.5 inches mercury)

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4.2.1 Test equipment and inspection facilities. Test equipment and inspection facilities shall be of sufficient accuracy, quality and quantity to permit performance of the required inspection. The supplier shall establish calibration of inspection equipment to the satisfaction of the Government. Calibration of the standards which control the accuracy of inspection equipment shall comply with the requirements of MIL-STD-45662.

4.3 Qualification inspection. Qualification inspection shall consist of the examinations and tests specified in Table III and the applicable specification sheet (see 3.1). The tests performed in Table III shall be performed on the samples specified in 4.3.4. Failure of any sample shall be cause for rejection. The qualifying activity shall be notified of the failure and the required corrective actions. Testing cannot be resumed until authorized by the qualifying activity. The failure mode and corrective action must be documented in the Qualification Test Record.

4.3.1 Retention of qualification. It shall be the responsibility of the qualified supplier to provide to the Government periodic verification of ability of qualified products to meet the requirements of this specification. Periodic verification shall be performed at 3 year intervals and shall consist of all Qualification inspection tests performed on any size single conductor cable and on any size multiconductor cable qualified to this specification. A summary of all the quality conformance tests performed in the three year period shall also be submitted along with the test record. The summary shall include the numbers and type of any failures. Failure to comply with these requirements may result in loss of qualification for that product.

4.3.2 Design changes. The manufacturer shall make no changes in materials or design or significant changes in processing without prior approval of the qualifying activity.

4.3.3 Qualification authorization. The supplier must be authorized to begin qualification inspection. Unauthorized qualification test data is not acceptable. A request for authorization to begin qualification inspection or periodic qualification inspection must be submitted to the Qualifying Activity (see 6.3).

4.3.4 Qualification test samples. The test sample size for qualification tests shall be a 200 foot sample of each type or size indicated below:

- a. Single conductor cable: Qualification of the following sizes shall cover the sizes indicated:

Size 14 - shall qualify sizes 18, 16, 14, 12 and 10.

Size 6 - shall qualify sizes 8, 6, 4 and 2.

Size 1/0 - shall qualify sizes 1, 1/0, 2/0, 3/0, 4/0 and 250.

- b. Multiconductor cable: Qualification of a 3-conductor cable shall cover all multiconductor cables in the sizes specified in (a. above). Unless otherwise specified by the qualifying activity, a separate multi-conductor cable for each size of construction shall be used to qualify cables containing wires of different sizes.

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TABLE III. Qualification tests wire and cable.

Test	Single conductor cable	Multi- conductor cable	Paragraph No.	
			Requirement	Test
Examination of product				
a. Conductor stranding	X	-	3.4.1	4.5.1
b. Dimensions	X	X	3.1	4.5.1
c. Weight	X	X	3.1	4.5.1
d. Markings	X	X	3.6	4.5.1
e. Length of lay	-	X	3.4.1.3	4.5.1
f. Color coding	-	X	3.4.6	4.5.1
Potential test 1/				4.5.2
a. Spark test 1/	X	X	3.5.1	4.5.2.1
b. High potential 1/	X	X	3.5.2	4.5.2.2
High temperature test	X	X	3.5.3	4.5.3
Impact (shock)	X	X	3.5.4	4.5.4
Abrasion resistance	X	X	3.5.5	4.5.5
Fluid immersion	X	X	3.5.6	4.5.6
Insulation resistance 1/	X	X	3.5.8	4.5.8
Low temperature 1/			3.5.9	4.5.9
a. Cold bend	X	X	3.5.9.1	4.5.9.1
b. Cold impact	X	X	3.5.9.2	4.5.9.2
Insulation thickness	X	X	3.4.3	4.5.10
Jacket thickness	-	X	3.4.5	4.5.11
Ozone resistance (when required)	X	X	3.5.10	4.5.12
Conductor resistance 1/	X	-	3.5.11	4.5.13
Bending endurance	X	X	3.5.12	4.5.14

1/ Inspection conditions of paragraph 4.2 do not apply to these tests for quality conformance inspections.

The specimens shall be manufactured by the supplier's routine production process and verified as such by the Government inspector. Any untested specimens required by the qualifying activity (see 4.3.5) shall come from the same lot as the qualification sample tested by the manufacturer.

4.3.5 Forwarding of qualification submittal. Unless otherwise specified by the qualifying activity, fifty feet of untested cable for each size range and type to be qualified, and the manufacturer's certified test reports shall be forwarded to the qualifying activity (see 6.4). The samples must be stamped by the Government inspector as representative samples of the manufacturer's normal production capability. Samples submitted without the stamp will not be accepted. These samples shall have tags attached to them with the following information:

- Manufacturer's name or CAGE number.
- Military part number for each construction.
- Description of insulating and jacketing materials.
- Thickness of insulation and jacket.
- Description of fillers, separator, etc. (if used).

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4.4 Quality conformance inspection. Quality conformance inspection shall consist of the following tests performed on every lot of wire or cable procured under this specification:

- a. Individual inspection.
- b. Sampling inspection.

4.4.1 Inspection of packaging. Except when commercial packaging is specified, the sampling and inspection of the preservation and interior package marking shall be in accordance with groups A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification shown in Section 5. The inspection of marking for shipment and storage shall be in accordance with MIL-STD-129. The inspection of commercial packaging shall be as specified in the contract (see 6.2).

4.4.2 Individual tests. All cable and wire produced in accordance with this specification shall be subjected to the following tests as described under "Test methods" (see 4.5).

- a. Examination of product (see 4.5.1).
- b. Spark test (see 4.5.2.1).
- c. High potential (wet dielectric) (see 4.5.2.2).

4.4.3 Sampling tests. Three samples shall be selected at random from each lot of 50,000 feet and one sample for each additional 10,000 feet of finished cable for each test listed below. The sample size shall not exceed one sample for each continuous length of finished cable. Specimen lengths shall be as specified in the individual test paragraphs. An inspection lot shall consist of all cable of the same military part number produced under essentially the same conditions and offered for inspection at the same time. Sampling tests shall consist of the following:

- a. Low temperature (see 4.5.9).
- b. High potential (wet dielectric) (see 4.5.2.2).
- c. Insulation resistance (see 4.5.8).
- d. Insulation thickness (see 4.5.10).
- e. Jacket thickness (see 4.5.11).
- f. Conductor resistance (see 4.5.13).

4.4.4 Rejection and retest. When sampling tests are specified on a number of samples that are selected as representative of a certain lot, and one or more of this number fails to meet the specified test(s), acceptance of

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all items shall be withheld until the extent and cause of failure is determined. Individual tests may be continued pending investigation of a Sampling test failure, but the final acceptance of the product is contingent upon the Inspector's decision regarding the overall performance of the product to specification requirements. If investigation indicates that the defects may exist on items previously accepted, full particulars concerning the defect(s) found, including recommendations for correction shall be furnished to the contracting activity.

4.5 Test methods.

4.5.1 Examination of product. Cable and wire shall be examined to ascertain compliance with this specification and the applicable specification sheet with respect to material, workmanship, construction, dimensions, stranding, identification and color coding.

4.5.2 Potential test.

4.5.2.1 Spark test. The insulation of each individual wire, prior to final assembly into the finished cable, shall be subjected to the test of Method 6211 of FED-STD-228. The test voltage shall be 3000 +100 volts AC and all wire sizes shall be tested. Any flaws detected in the insulation shall be removed.

4.5.2.2 High-potential (wet dielectric) test. Each reel or spool of finished cable shall be immersed in tap water for a period of 6 hours after which a minimum 3000 +100 volts shall be impressed in the following manner for a minimum period of one minute:

Single-conductor cable - Between the conductor and water.

Multi-conductor cable - Between each conductor and all other conductors connected together and to the water.

4.5.3 High-temperature tests. A minimum 2 feet +3 inches specimen stripped to the bare conductor or conductors, 1 to 1-1/2 inches from each end, shall be suspended around a mandrel 5 +1/2 times the outside diameter of the cable. A weight, as shown in Table II for the applicable size of cable shall be attached to the exposed conductor at each end. The specimen on the mandrel with the weights freely suspended shall be placed in a circulating air oven maintained at a temperature of 100 +2°C for a minimum period of 120 +1 hours. The weight shall be removed from the specimen when the specimen has been allowed to cool to room temperature. The bent portion of the specimen shall then be bent not less than 180 degrees around the mandrel in the opposite direction with the opposite side of the cable in contact with the mandrel at a uniform rate for a minimum 180-degree bend within 30 seconds. The specimen shall then be subjected to the dielectric test of 4.5.7. Following the dielectric test, and within 24 hours, the specimen shall be subjected to the abrasion test of 4.5.5, using 70 percent of the minimum number of oscillations specified in Table II.

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4.5.4 Impact (shock). Three 18-inch (minimum) specimens of completed cable shall be used for this test.

4.5.4.1 Heat conditioning. The specimens shall be freely suspended in an air oven at a temperature of $+71^{\circ} \pm 1^{\circ}\text{C}$ for a minimum period of 72 ± 1 hours. At the expiration of the 72-hour period, the specimens shall be removed from the oven and allowed to remain at room temperature for a minimum of 24 hours, after which they shall be subjected to the following test.

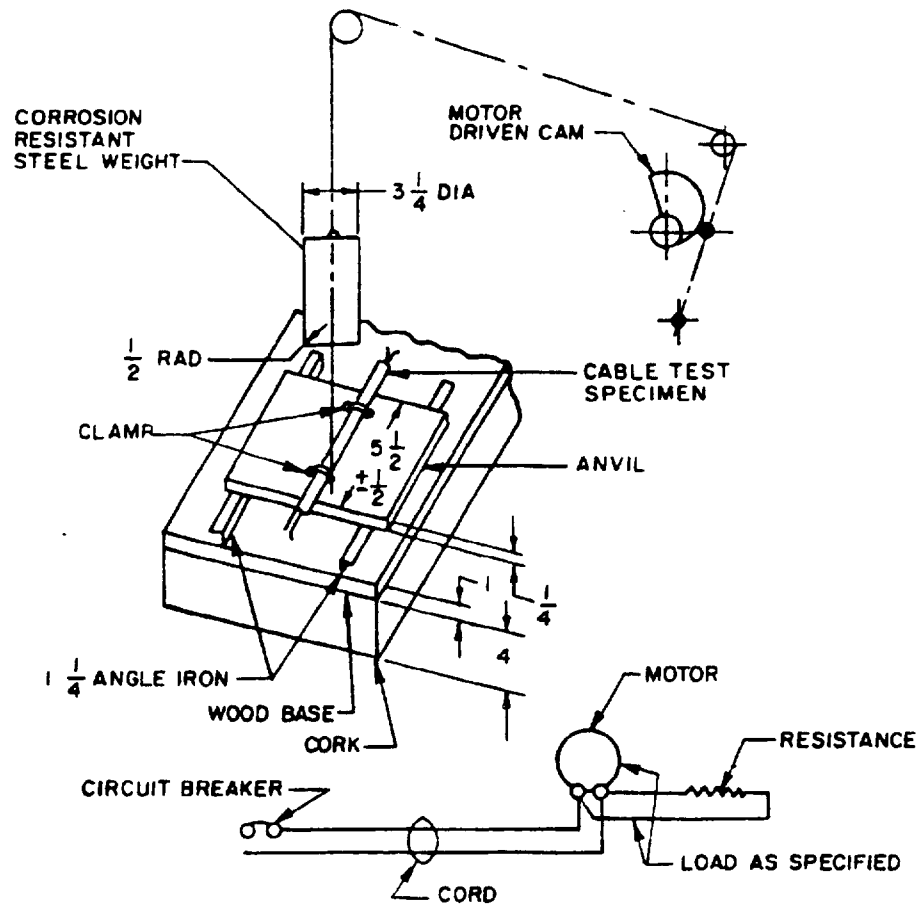
4.5.4.1.1 Procedure. The impact shall consist of dropping a 23 $\pm 1 - 0$ pound weight a distance of 6.5 $\pm 1/2$ inch, minus the outside diameter of the test sample, on the center portion of the sample while it is clamped flat on a smooth metal plate as shown on Figure 1. The drops shall be made at the rate of 25 ± 2 per minute. There shall be a continuous current of 3 $\pm 1/2$ amperes through size 18 and smaller conductors, 5 $\pm 1/2$ amperes through size 16, and 15 $\pm 1/2$ amperes for size 14 and larger, while undergoing this test. To detect interior short circuit or failure, 1/3 to 1/2 of the conductors of a multi-conductor cable shall be permanently connected in series with adjacent conductors connected into the load circuit. The minimum number of shocks shall be not less than specified in Table II based on the average for three samples.

4.5.5 Abrasion test. Two untested samples 2.5 feet minimum in length shall be mounted securely at one end and weights as specified in Table II freely suspended to the other end with the cable placed over a squirrel cage abrasion tested as shown on Figure 2. A suitable tripping circuit shall be arranged to denote failure by stopping the machine when any bar of the squirrel cage comes in contact with the bare conductor of the cable or wire. The specimen shall be subjected to 20 ± 2 oscillations per minute. The minimum number of oscillations to failure shall be as specified in Table II. An oscillation shall consist of 5 bars travel forward and backward from a given point.

4.5.6 Fluid immersion. Four individual samples 2.5 feet minimum in length shall be stripped to the bare conductor on either end for 1 inch and formed in a loop not less than 5 times the diameter of the cable. A minimum of 18 inches of the cable shall then be placed in each of the fluids specified in Table IV for the time specified. Within 15 minutes after completion of the soaking and air drying, the increase in diameter shall be measured. Samples shall be subjected to the Dielectric test of 4.5.7 and the Abrasion test of 4.5.5 using 70 percent of the minimum number of oscillations in Table II.

4.5.7 Dielectric test. This method applies to specimens previously conditioned in the tests of 4.5.3, 4.5.6 and 4.5.9. Unless otherwise specified, the test sample shall consist of approximately 2-foot lengths of cable with the insulation, filler and outer protective jacket, as applicable, removed for a distance of 1 inch from the ends of each specimen or each conductor in multiconductor cable. Filler and outer jacket shall be removed from the stripped conductors of multiconductor cable a minimum of 3 inches on each end.

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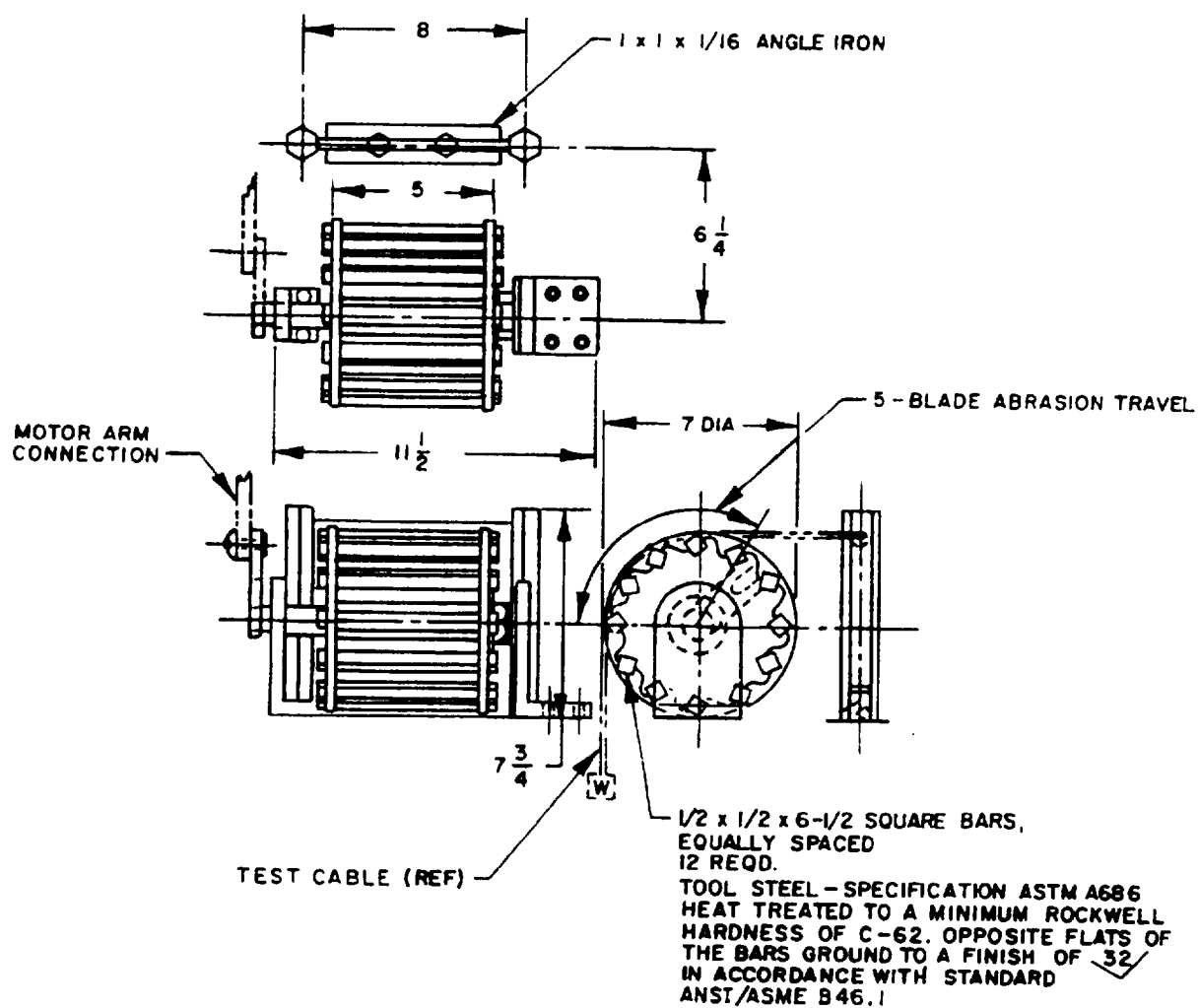


WIRING DIAGRAM

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: FRACTIONS = $\pm 1/64$

FIGURE 1. Impact (shock).

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DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: FRACTIONS = $\pm 1/64$

FIGURE 2. Abrasion test apparatus.

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TABLE IV. Fluids.

Fluid	Soak time (hours)	Air-drying time (hours)
Hydrocarbon fluid (Specification TT-S-735, Type III)	4	2
Isopropyl alcohol (Specification TT-I-735)	4	2
Chemical, analytical		
Kerosene and aircraft lubricating oil, 50% each at 48° to 50°C (Specifications ASTM D3599 and MIL-L-6082, grade 1100, respectively)	16	3

4.5.7.1 Procedure. The specimen shall be formed into a loop, and the ends of the conductor or conductors shall be twisted or clamped together. The loop thus formed shall be immersed in tap water in order that not more than 1-1/2 inches of each end of the insulation will protrude above the surface of the water for a period of four hours. At the conclusion of the four-hour period of immersion and while the specimen is still immersed, the applicable voltage below shall be applied between each conductor and all other conductors and the water for a period of 1 minute.

Conductor Size (AWG)	Test Voltage (at 60 Hertz)
18-16	1500
14-8	3000
6-2	3500
1-4/0	4000
250 kcmil	5000

4.5.8 Insulation resistance. The insulation resistance shall be determined using Test Method 6031 of FED-STD-228, except the time of water immersion shall be 4 hours minimum. A direct-current potential of 100-500 volts shall be used. If a temperature correction factor is used to convert the insulation resistance value to 60°F, it shall be furnished by the cable manufacturer.

4.5.9 Low temperature.

4.5.9.1 Cold bend. A specimen of sufficient length of cable or wire shall be placed in a cold chamber and conditioned at -54° +2°C for 4 hours minimum. Upon the completion of the conditioning period and while still at -54°C, the specimen shall be bent twice around a mandrel of a diameter 5 to 7 times the outer diameter of the specimen within 24 +6 seconds at a uniform rate of five turns per minute for two complete turns. The specimen shall remain in contact with the mandrel during the test. The mandrel shall be rotated by a handle or other control located outside the cold chamber. Upon

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completion of this test and within 15 minutes the specimen shall be subjected to the dielectric test of 4.5.7.

4.5.9.2 Cold impact test. A specimen of sufficient length of cable, whose outer jacket has been removed for approximately 1 foot on one end, shall be placed in a cold chamber and conditioned at $-54^{\circ} \pm 2^{\circ}\text{C}$ for 4 hours minimum. Upon completion of the conditioning period and while still at -54°C , the cable shall be placed on an anvil consisting of 3/8-inch steel plate and subjected to a 3 to 3-1/2 foot-pound impact by dropping a weight having a ball-shaped end with a $1/2 \pm 1/64$ inch radius through a tube at right angles to the specimen. Individual insulated conductors shall be subjected to a .25 to .31 foot-pound impact. Three drops shall be made at the same spot on the specimen. Upon completion of this test, the specimens shall be subjected to the Dielectric test of 4.5.7.

4.5.10 Insulation thickness. Measurement of thickness shall be made in accordance with Method 1011 or 1014 of FED-STD-228.

4.5.11 Jacket thickness. Measurement of thickness shall be made in accordance with Method 1011 or 1014 of FED-STD-228.

4.5.12 Ozone resistance. The test samples shall consist of at least four specimens of the finished cable and at least six specimens of each color of insulated wire removed from the finished cable. The length of each specimen shall be sufficient to allow cable of 1 inch or less diameter to be wrapped a minimum of 5 turns on the appropriate mandrel listed below and over 1.00 inch diameter cable to be wrapped a minimum of 3 turns on the appropriate mandrel listed below. Mandrel sizes are:

<u>Specimen Diameter (Inches)</u>	<u>Mandrel Diameter</u>
0.0 to 0.500	3-1/2 to 4 $\pm 1/2$ x specimen diameter
0.501 to 0.750	4-1/2 to 5 $\pm 1/2$ x specimen diameter
0.751 to 1.250	5-1/2 to 6 $\pm 1/2$ x specimen diameter
1.251 to 1.750	7-1/2 to 8 $\pm 1/2$ x specimen diameter
1.751 and larger	9-1/2 to 10 $\pm 1/2$ x specimen diameter

The specimens must be at room ambient for at least one week before sample preparation. One half of the test specimens shall be tested for ozone resistance after heat aging and one half shall be tested unaged. The heat aging shall be at $158^{\circ}\text{F} \pm 5^{\circ}\text{F}$ (70°C) for $70 \pm .5$ hours and the specimens shall then be kept at room ambient for at least four days after removal from the aging oven and before the ozone test. The ozone test shall be conducted per ANSI/ASTM D1149 except the chamber temperature shall be $100^{\circ}\text{F} \pm 5^{\circ}\text{F}$, the ozone concentration shall be 50 ± 3 parts ozone per 100,000,000 parts of air, and the exposure time shall be 168 ± 1 hour. At the end of the exposure, the mounted specimens shall be removed from the chamber and allowed to cool to room temperature. The specimens shall be examined for cracks in the jacket or insulating materials under a seven power optical magnifier.

4.5.13 Conductor resistance. The direct current resistance of each conductor shall be measured on the finished wire or cable as specified in Method 6021 of FED-STD-228, except that immersion is not required and a Kelvin

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bridge or other suitable instrument may be used. The increase in conductor resistance per foot due to cabling in multiconductor cables is incorporated into the conductor resistance values of the specification sheets.

4.5.14 Bending endurance. Three samples of the completed cable shall be prepared in accordance with Figure 3 and the conductors connected in series as shown in Figure 4. These samples shall be subjected to 2000 (minimum) flexural cycles using the fixture shown in Figure 5. A 110 V, 60 Hz AC potential with a load current of not less than 0.5 amperes shall be impressed on each conductor and shown on an ammeter.

5. PACKAGING

5.1 Preservation.

5.1.1 Spools or reels. Cable shall be delivered wound on reels or on spools having an appropriate diameter for the respective size. Unless otherwise specified in the order, the cable and wire lengths shall conform to Table V.

5.1.2 Cable lengths. Not less than 85 percent of the total quantity of each size of cable ordered shall be in lengths equal to or greater than the nominal length specified in Table V. No cable shall be accepted in lengths shorter than the given minimum acceptable length. The maximum quantity in a single length shall be limited only by manufacturing and handling facilities. Special lengths, when required, shall be as specified in the contract or order.

TABLE V. Cable lengths.

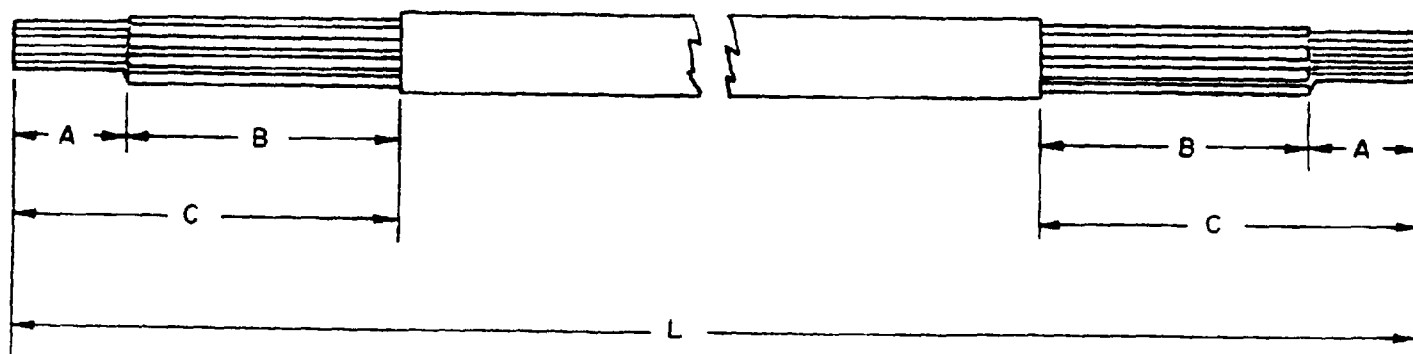
Overall diameter of cable	Nominal length on reel or spool Feet	Acceptable length (min) Feet
Smaller than 0.625	500	50
0.625 to 1.10	250	50
Greater than 1.10	100	25

5.2 Packing (see 6.2). Unless otherwise specified, all items shall be packed for overseas shipment. Shipping containers, insofar as possible, shall contain identical number of articles, shall be of a uniform size, and shall be designed to enclose the contents in a snug, tight-fitting manner. The gross weight of the exterior shipping container when packed for shipment shall not exceed approximately 250 pounds, unless the weight of the individual spool or reel exceeds this amount.

5.2.1 Overseas shipment. The reels or spools shall be packed in exterior shipping containers in accordance with specification PPP-B-621, overseas type. Plywood, if used, shall conform to NN-P-530, Group A, Type I or II, Grade 4.

5.2.2 Domestic shipment. When specified, the reels or spools shall be packed in substantial commercial exterior shipping containers so constructed to ensure acceptance by common or other carrier for safe transportation at the

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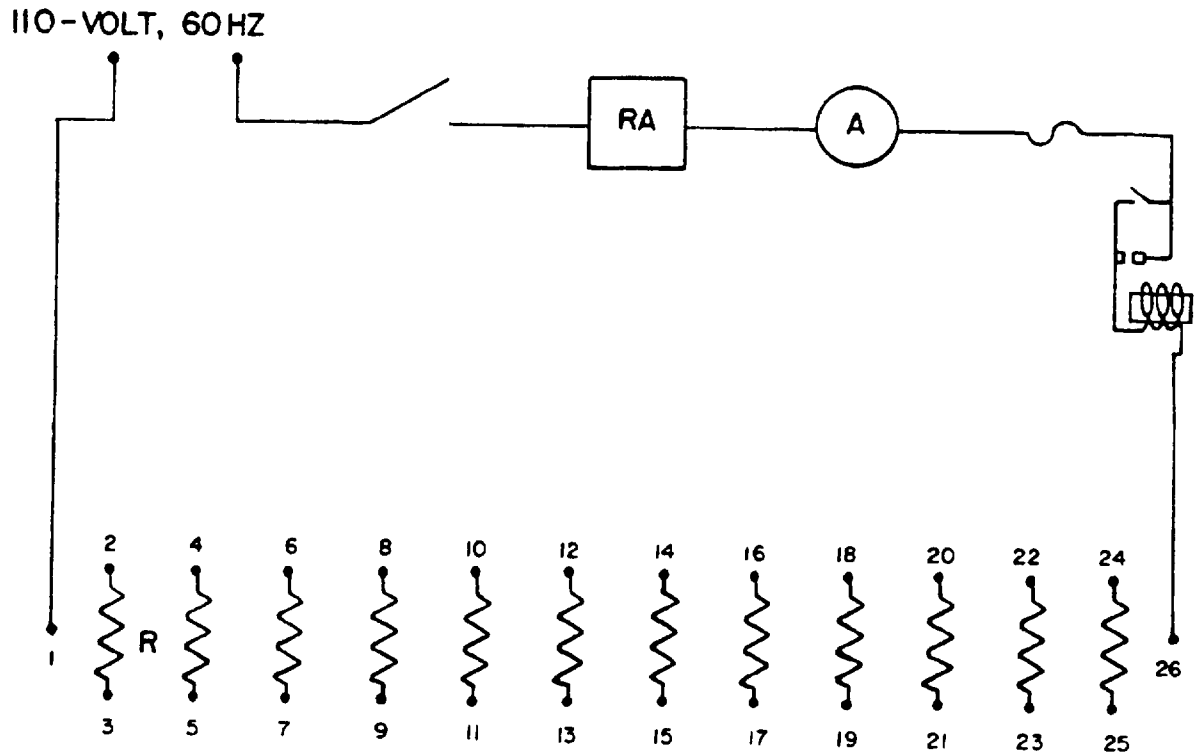
$A = 1\text{-}1/2'' \pm 1/16''$
 $B = 2'' \pm 1/16''$
 $C = 3\text{-}1/2'' \pm 1/16''$

SET OF SAMPLES TO CONSIST OF
 3 SAMPLES FOR BEND, $L = 42'' \pm 1''$

CABLE SAMPLES

FIGURE 3. Bending endurance.

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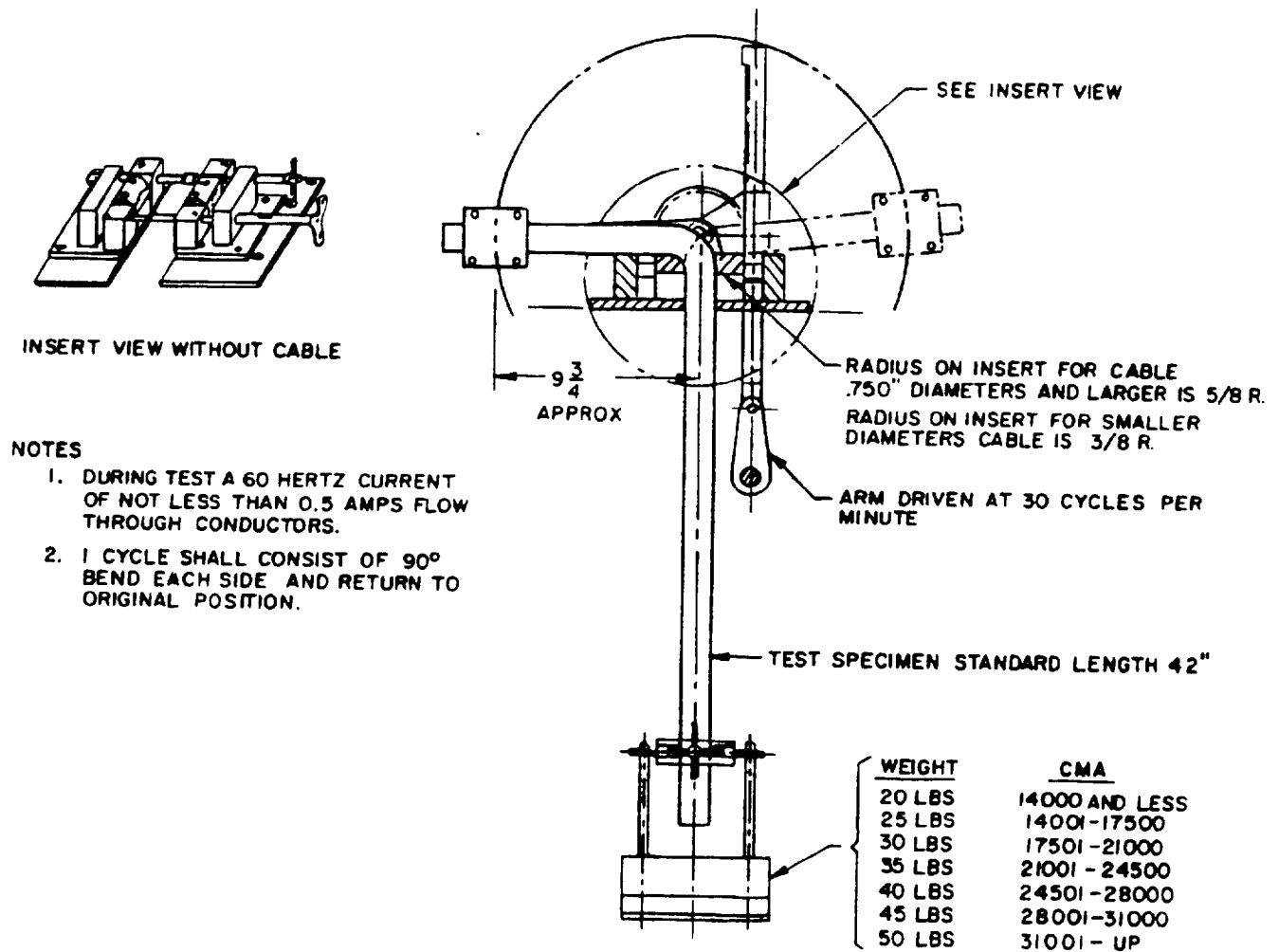
R- $20 \pm 10\%$ OHM RESISTOR

A-AMMETER

RA-RECORDING AMMETER

FIXTURE, CABLE TESTING ELECTRICAL CIRCUITFIGURE 4. Bending endurance.

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BEND TEST, FIXTURE, CABLE TESTING

FIGURE 5. Bending endurance.

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lowest rate, to the point of delivery. The use of corrugated or solid fiberboard is prohibited. Containers shall be able to withstand storage, rehandling and reshipment without the necessity of repacking.

5.3 Marking of shipments. Interior packages and exterior shipping containers shall be marked in accordance with standard MIL-STD-129. The nomenclature shall be as follows:

Cable, Power, Electrical
 Number of conductors * Size of conductors *
 Conductor and overall insulation *
 Working or test voltage *
 Specification MIL-C-5756
 Manufacturer's Part No. *
 National Stock No. * (if no NSN available, leave space therefor)

*Applicable data to be entered by the contractor

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The cable and wire covered by this specification are intended for ground equipment wherever a 600-volt jacketed, single or multi-conductor cable is required. Typical uses are: power cables for portable tools, lighting equipment, portable generating equipment and temporary power distribution systems and as the cable portion of MIL-C-7974 aircraft ground power cable assemblies.

6.2 Acquisition requirements. Procurement documents should specify the following:

- a. Title, number and date of this specification.
- b. Issue of DODISS to be cited in the solicitation (see 2.2).
- c. Applicable specification sheet number, title and date.
- d. Applicable specification sheet part number.
- e. Quantity required.
- f. Levels of packaging and packing required.
- g. Exemptions, if any, to the optional provisions of this specification.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved 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

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requirement, 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. The activity responsible for the Qualified Products List is the Naval Air Systems Command, Washington, DC 20360; however, information pertaining to qualification of products may be obtained from the Naval Avionics Center, Code B/444, 6000 East 21st Street, Indianapolis, IN 46219-2189.

6.4 Definitions. For the purpose of this specification, the following definitions will apply.

6.4.1 Strand. A strand is one of the filaments of a stranded conductor.

6.4.2 Conductor. A conductor is a slender rod or filament of drawn metal of circular cross section, or a group of such rods or filaments, not insulated from one another, suitable for transmitting an electric current.

6.4.3 Insulation. Insulation is a layer of synthetic or natural rubber compound applied directly over a conductor for the purpose of insulating the conductor.

6.4.4 Jacket. A jacket is an outer layer of synthetic or natural rubber compound applied over a wire or assembled core of wires for the purpose of protection from physical abuse.

6.4.5 Wire. A wire is a single-insulated, stranded copper conductor without metallic covering, shielding or jacketing.

6.4.6 Cable. A cable consists of a single conductor with either the insulation separate or combined with the cable jacket or two or more individually insulated conductors contained in a common jacket.

6.4.7 AWG. Abbreviation for American Wire Gauge.

6.4.8 Butt joint. A joint or splice wherein two wires or two bunched rope members from opposite ends are joined end to end with no overlap and the axes in line.

6.4.9 kcmil. Abbreviation for a thousand circular mils. The designation kcmil supersedes MCM.

6.5 Subject term (keyword) listing.

Conductor
Insulation
Jacket
Strand
Wire

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

Custodians:

Navy - AS
AF - 85

Preparing activity:

Navy - AS
(Project No. 6145-1121)

Review activities:

Army - CR
DLA - GS
DLA - IS

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-C-5756C		2. DOCUMENT TITLE CABLE, POWER, ELECTRICAL, PORTABLE GENERAL SPECIFICATION FOR	
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION (Mark one)	
		<input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER (Specify): _____	
b. ADDRESS (Street, City, State, ZIP Code)			
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER (Last, First, MI) - Optional		b. WORK TELEPHONE NUMBER (Include Area Code) - Optional	
c. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional		8. DATE OF SUBMISSION (YYMMDD)	

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