AEROSPACE STANDARD	AS5756™	REV. C
	Issued 2004-06 Revised 2021-02 Superseding AS5756B	

Cable, Power, Electrical, Portable General Specification for

RATIONALE

Revision required to add material, conductor, and temperature requirements.

1. SCOPE

1.1 Scope

This specification covers 600 V heavy duty, portable, power, single and multiconductor, electrical cable for severe flexing service (see detail specifications for voltage limitations). The AS5756 insulation system has been used in aerospace ground power applications using 115/200 V (phase to neutral) at 400 Hz AC. Verification of the suitability of this product for use in other electrical system configurations (600 V, etc.) is the responsibility of the user.

1.2 Classification

Cable of this specification shall be in accordance with the applicable detail specification (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 AS5756.

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 detail specification shall describe the material and construction details of finished cable and components.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: **http://www.sae.org**

For more information on this standard, visit
https://www.sae.org/standards/content/AS5756C/

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and 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.

2.1.1 SAE International Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS4373	Test Methods for Insulated Electric Wire
AS5756/1*	Cable, Power, Electrical, 600 Volts, Portable, Single Conductor, Non-Ozone Resistant
AS5756/2*	Cable, Power, Electrical, 600 Volts, Portable, Single Conductor, Ozone Resistant
AS5756/3*	Cable, Power, Electrical, 600 Volts, Portable, Multiconductor
AS5756/4*	Cable, Electrical, 600 Volts, Portable, Multiconductor, Ozone Resistant
AS5756/5*	Cable, 3-Phase Power, Electric, Portable, Multiconductor, 90 °C, 600V, Ozone Resistant, Split Neutral
AS5756/6*	Cable, 3-Phase Power, Electric, Portable, Multiconductor, 90 °C, 600V, Ozone Resistant, Split Phase
AS5756/7*	Cable, Low Inductance, 270 Volt DC
AS9003	Inspection and Test Quality Systems Requirements for Aviation, Space, and Defense Organizations
J1966	Lubricating Oils, Aircraft Piston Engine (Nondispersant Mineral Oil)

*AS5756 detail specification

2.1.2 ANSI Accredited Publications

Copies of these documents are available online at http://webstore.ansi.org/.

ANSI/ASME B46.1	Surface Texture

2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM B3	Standard Specification for Soft or Annealed Copper Wire
ASTM B33	Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
ASTM B172	Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors

ASTM B174 Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors

ASTM D471 Standard Test Method for Rubber Property-Effect of Liquids

ASTM D1149 Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment

ASTM D3699 Standard Specification for Kerosene

ASTM D6880/D6880-11 Standard Specification for Wood Boxes

2.1.4 National Conference of Standards Laboratories (NCSL) Publications

Available from NCSL International, 2995 Wilderness Place, Suite 107, Boulder, CO 80301, Tel: 303-440-3339, www.ncsli.org.

NCSL Z540-3 Calibration of Measuring and Test Equipment, Requirements for

2.1.5 U.S. Government Publications

Copies of these documents are available online at https://quicksearch.dla.mil.

A-A-55057 Panels, Wood/Wood Based; Construction and Decorative

A-A-59551 Wire, Electrical, Copper (Uninsulated)

MIL-STD-104 Limits for Electrical Insulation Color

MIL-STD-129 Marking for Shipment and Storage

FED-STD-228 Test Methods for Cables and Wires, Insulated

MIL-STD-2073-1 Standard Practice for Military Packaging

SAM System for Award Management*

SD-6 Provisions Governing Qualification

TT-I-735 Isopropyl Alcohol

*Available from https://www.sam.gov/portal/public/SAM/.

2.2 Definitions

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

2.2.1 STRAND

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

2.2.2 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.

2.2.3 INSULATION

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

2.2.4 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.

2.2.5 WIRE

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

2.2.6 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.

2.2.7 AWG

Abbreviation for American Wire Gauge.

2.2.8 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.

2.2.9 KCMIL

Abbreviation for a thousand circular mils. The designation kcmil supersedes mcm.

3. REQUIREMENTS

3.1 Detail Specification

The requirements for the component wire and finished cable furnished under this specification shall be as specified herein and in accordance with the applicable detail specification. In the event of any conflict between the requirements of this specification and the detail specification, 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 or purchase order (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 herein and the detail specification.

3.3.1 Conductor Materials

All strands used in fabricating the conductors of this specification shall be annealed copper strands 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

Unless otherwise specified in the applicable detail specification, individual copper strands shall be uniformly coated with commercially pure tin for conductor 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 detail specification 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 detail specification.

3.4 Design and Construction

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

3.4.1 Conductors

Stranded conductors shall be annealed copper wire in accordance with A-A-59551, Temper 1 and coating B or T as specified. Unless otherwise specified in the detail specification conductor sizes 18-14 shall be Type B, Class M of A-A-59551. When specified in the detail specification conductor size 14 shall be Type B, Class K of A-A-59551. Conductors sizes 12-4/0 and 250 kcmil shall be Type R, Class M of A-A-59551. All conductors shall conform to the requirements of Table 1 of this specification unless otherwise required by the detail specification.

Table 1 - Requirements for conductors

Wire Size (AWG)	Minimum No. of Strands	Lay-Up of Strands 2/	Minimum Conductor Diameter (Inch)	Nominal Conductor Diameter (Inch 1/)	Maximum Conductor Diameter (Inch)
18	41	1 x 41	0.046	0.048	0.050
16	65	1 x 65	0.057	0.060	0.063
14	41	1 x 41	0.068	0.073	0.078
14	104	1 x 104	0.074	0.078	0.082
12	165	1 x 165	0.095	0.101	0.106
12	168	7 x 24	0.100	0.105	0.110
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
Metric diameters may be determined based on 2.54 cm per inch.					

1/ Nominal values are given for information only.

2/ Other stranding constructions may be used provided the cable contain the minimum number of strands, and conform to the dimensions and resistance requirements of AS5756 and applicable detail specification.

3.4.1.1 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.

3.4.1.2 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 10-4/0 and 250) shall be in accordance with ASTM B172.

3.4.2 Separator

When rope lay conductors (Type R, Class M) are used, a separator of suitable material shall be applied between the conductor and the insulation. When bunch lay conductors (Type B, Class M) are used, the application of such a separator is optional with the supplier. The inner wrap of suitable tape 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 detail specification (see 4.5.10).

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 2 unless otherwise specified in the applicable detail specification (see 4.5.11).

Table 2 - 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
Metric diameters may be determined based on 2.54 cm per inch and weights 0.45 kg per pound.				

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 detail specification. The color limits shall be in accordance with MIL-STD-104, Class 2. The conductors shall be cabled together in the color sequence shown in Table 2A. Unless otherwise specified the insulation of the center conductor shall be colored black.

Table 2A - Cable conductor colors

Conductor Number	Conductor Insulation Color
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.

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 V ± 100 V spark test to assure there are no electrical defects in the insulation. Any portions of the insulated conductor failing to withstand 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 VAC ± 100 VAC 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% of the minimum number of abrasion resistance oscillations of Table 2 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 2 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 2 using the applicable weights from Table 2 (see 4.5.5).

3.5.6 Fluid Immersion

The cable shall not increase in diameter more than 15%, shall meet the dielectric requirement of 3.5.7, and shall meet 70% of the minimum number of abrasion resistance oscillations of Table 2 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 100 feet at 60 °F)

k = 2000 unless otherwise specified (see 4.5.8)

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 un-aged 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 per 1000 feet shall not exceed that shown in the applicable detail specification (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).

3.5.13 Insulation and Jacket Physicals (Tensile Strength and Elongation)

When specified in the applicable detail specification, the tensile strength and elongation of two unaged insulation and jacket materials shall meet the minimum requirements of the applicable detail specification as tested in 4.5.15. The materials shall be removed from each end of the completed cable sample (see 4.3.8).

3.5.14 Air Oven Accelerated Aging (See 6.1.2)

When specified in the applicable detail specification, two specimens shall be removed from each end of the completed cable (see 4.3.8). The specimens shall maintain a minimum retention of 75% of the tensile strength and elongation of the unaged materials (see 3.5.13) when tested in 4.5.16.

3.6 Identification of Product

All cables shall be identified by surface printing on the outside of the jacket or combined insulation and jacket in addition to any marker tape which may be used. Single conductor cables size 8 and larger and all multiconductor cables shall have a marker tape approximately 1/8-inch-wide (0.318 cm) 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 (45.7 cm), as measured from the start of one complete marking to the beginning of the next. The jacket and when required the marker tape shall have the following information (see 4.5.1):

3.6.1 Marker Tape

3.6.1.1 SAE specification part number of the cable including the slash but not including the dash number (see 3.1).

3.6.1.2 The supplier's Commercial and Government Entity (CAGE) designation in accordance with SAM (see 2.15).

3.6.1.3 The year of manufacture of the cable (i.e., M5756/2 12345 2018).

3.6.2 Jacket Marking

3.6.2.1 SAE specification part number of the cable including both the slash and the dash number (see 3.1).

3.6.2.2 The supplier's Commercial and Government Entity (CAGE) designation in accordance with SAM (see 2.15).

3.6.2.3 The year of manufacture of the cable (i.e., M5756/2 12345 2018).

3.6.3 Use of SAE Designations

SAE designations shall not be applied to a product, except for Qualification test samples, nor referred to in correspondence until the Qualifying Activity has approved the product for QPL listing (see 6.3).

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 supplier is responsible for the performance of all contract inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the supplier may use any Qualifying Activity approved facilities suitable for the performance of the inspection requirements specified herein. The purchaser and Qualifying Activity have 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.

4.1.1 Responsibility for Compliance

All items must meet all technical requirements of the product specification. The inspection set forth in this specification shall become a part of the supplier's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the supplier of the responsibility of assuring that all products comply with all requirements of the contract or purchase order. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the purchaser to acceptance of defective material.

4.1.2 Test Equipment and Inspection Facilities

Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the supplier. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with NCSL Z540-3 or equivalent standards.

4.1.3 AS9003 Quality Assurance Compliance

The supplier's quality assurance program for wire production shall comply with the AS9003 Inspection and Test Quality System. Independent certification of the processes is not required. Other established and industry recognized quality assurance standards that assure all products produced conform to the contract requirements are acceptable. However, if used, it is the responsibility of the supplier to provide evidence of compliance to AS9003. The Qualifying Activity (QA) authority reserves the right to monitor, measure, and validate compliance at their discretion.

4.1.4 Classification of Inspections

The inspections conditions specified herein are classified as follows:

a. Initial Qualification Inspection (see 4.3)

b. Retention of Qualification Inspection (see 4.3.2)

c. Quality Conformance Inspection (see 4.4)

4.2 Inspection Conditions

Unless otherwise specified herein or in the detail specification, all measurements and tests shall be made at temperatures of 15 to 35 °C (59 to 95 °F) at air pressure of 650 to 800 mm of mercury, and a relative humidity of 45 to 75%. Whenever these conditions must be closely controlled in order to obtain more reproducible results, the temperature, relative humidity, and atmospheric pressure conditions of 25 +0, -2 °C (77 +0, -3.6 °F), 50% ± 12% Relative Humidity, and 650 to 800 mm of mercury shall be used.

4.3 Initial Qualification Inspections (see 6.3)

Initial qualification inspection shall be in accordance with Tables 3 and 3A. Sequential testing is not required except as specified by a test method. Unless otherwise specified in the detail specification, the Qualifying Activity shall perform or witness the tests specified in Table 3 and the supplier shall perform the tests Table 3A. All test laboratories require Qualifying Activity approval.

4.3.1 Initial Qualification Inspection Procedure

A request for qualification shall be made to the Qualifying Activity (see 6.3) prior to initiating testing. Testing cannot begin until the supplier has received an authorization letter. The supplier is recommended to provide the Qualifying Activity a test plan based on the authorization letter to ensure the supplier and Qualifying Activity maintain communication and document changes as needed. The Qualifying Activity shall not approve a component that does not meet the requirements specified herein. The Qualifying Activity has the authority to impose specific specification test requirements to resolve test failures/discrepancies and to waive testing to verify specific product manufacturing changes or qualifications by similarity. Any change in the supplier's process control inspections, quality conformance inspections, or manufacturing control drawings (editorial changes are acceptable) without the express approval of the Qualifying Activity may result in loss of qualification for that product.

4.3.2 Initial Qualification Test Reports

The Qualifying Activity shall provide the supplier a data package of all tests performed in accordance with Table 3. The Qualifying Activity test method procedures shall be made available to the supplier upon request. The supplier shall provide a test report to the Qualifying Activity for the tests specified in Table 3A. The test report shall be signed by the manufacturing authority responsible for ensuring compliance to the specification requirements. The supplier may combine the Qualifying Activity test data with the supplier's test data into complete test report. The test report and/or data package shall remain on file with the supplier for a minimum period of 6 years and be available to the Qualifying Activity upon request. The supplier test report shall contain as a minimum the following information.

a. Copy of all certifications specified herein.

b. The quantitative results for tests specified in Table 13 and the authorization letter.

c. A tabulated comparison between the insulation and conductor construction herein and each manufacturing control drawing for components qualified by similarity.

d. Corrective Action Reports (as applicable).

Table 3 - Qualifying activity test requirements

Examination or Test	Requirement Paragraph	Examination or Test Paragraph
Conductor stranding 1/	3.4.1	4.5.1
Dimensions	3.1	4.5.1
Weight	3.1	4.5.1
Identification of product	3.6	4.5.1
Length of lay 2/	3.4.1.2	4.5.1
Color coding 2/	3.4.6	4.5.1
Insulation thickness	3.4.3	4.5.10
Jacket thickness 2/	3.4.5	4.5.11
Insulation resistance 3/	3.5.8	4.5.8
Cold bend 3/	3.5.9.1	4.5.9.1
Cold impact 3/	3.5.9.2	4.5.9.2
Conductor resistance 1/, 3/	3.5.11	4.5.13
Insulation and Jacket Physical	3.5.13	4.5.15
Air Oven Accelerated Aging 3/	3.5.14	4.5.16

1/ Not required for multi-conductor cable.
2/ Not required for single conductor cable.
3/ Required every other qualification retention cycle.

Table 3A - Supplier test requirements

Examination or Test	Requirement Paragraph	Examination or Test Paragraph
Spark test	3.5.1	4.5.2.1
High potential high	3.5.2	4.5.2.2
temperature test	3.5.3	4.5.3
Impact shock	3.5.4	4.5.4
Abrasion resistance	3.5.5	4.5.5
Fluid immersion	3.5.6	4.5.6
Ozone resistance 1/	3.5.10	4.5.12
Bending endurance	3.5.12	4.5.14

1/ When required by the detail specification.

4.3.3 Retention of Qualification Inspection

At 36-month intervals, the Qualifying Activity shall authorize the supplier to begin Retention of Qualification. The Qualifying Activity may establish an alternate due date to accommodate testing schedules. The supplier shall provide a retention of qualification test report. The Qualifying Activity shall perform the Table 3 tests on samples, which have passed the quality conformance inspection (see 4.4). The Qualifying Activity will provide certified data to the supplier upon request. Failure to submit to Retention of Qualification shall result in loss of qualification for that product.

4.3.4 Retention of Qualification Test Report

The supplier shall furnish the Qualifying Activity one certified test report containing the following information:

a. A summary of the results of quality conformance tests, including corrective actions performed during the retention period indicating as a minimum, the number of lots that passed and the number that failed.

b. A tabulated comparison of the dimensions specified herein and each manufacturing control drawing for components qualified by similarity.

4.3.5 Initial and Retention Qualification Similarity Sample Lot

The test sample lot size for initial and retention of qualification tests shall be a 200 minimum foot specimen of each type or size indicated below:

a. Single conductor cable: Qualification of size 14 shall qualify sizes 18, 16, 14, 12, and 10. Qualification of size 6 shall qualify sizes 8, 6, 4, and 2. Qualification of size 1/0 shall qualify sizes 1, 1/0, 2/0, 3/0, 4/0, and 250 kcmil.

b. Multi-conductor cable: Qualification of a 3-conductor cable shall cover all multi-conductor 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 wire of different sizes.

Additional qualification by similarity may be authorized by the Qualifying Activity when justified by the supplier. The supplier and Qualifying Activity shall perform all tests on samples from the same lots.

4.3.6 Statistical Process Control

Suppliers demonstrating statistical product acceptance requirements (refer to ARP9013) may waive specific individual quality conformance inspection tests or retention of qualification test (one retention period only) when justified and approved by the Qualifying Activity. The spark test and high potential test cannot be waived. The supplier shall demonstrate to the Qualifying Activity consistent repeatable results for a specific quality conformance inspection property by tight process controls (statistical, etc.), and relationship of that control to tests requested for waver. The Qualifying Activity authority reserves the right to monitor, measure, and validate compliance at their discretion.

4.3.7 Qualification Non-Compliance

Failure to pass all qualification requirements shall result in disapproval of the components that failed and the family of components represented by the failed components.

4.3.8 Forwarding of Qualification Test Report and Specimens

Unless otherwise specified by the Qualifying Activity, 15 feet of untested cable for each size range and type to be qualified, and the supplier's certified test report shall be forwarded to the Qualifying Activity. The specimens shall be stamped by the Qualifying Activity designated inspector as representative sample lot of the supplier's normal production capability. Specimens submitted without the stamp will not be accepted. Tags shall be attached to specimens with the following information:

a. Supplier's name or CAGE number (see SAM).

b. Specification part number for each construction.

c. Description of insulating and jacketing materials.

d. Thickness of insulation and jacket.

e. Description of fillers, separator, etc. (if used).

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 quality conformance inspection requirements of MIL-STD-2073-1. 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 50000 feet and one sample for each additional 10000 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 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 (4.5.13).

g. Insulation and jacket physical (4.5.15).

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 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 detail specification 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 505 of AS4373 Method 1. The test voltage shall be 3000 VAC ± 100 VAC 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 V ± 100 V shall be impressed in the following manner for a minimum period of 1 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 (61 cm ± 5.1 cm) specimen stripped to the bare conductor or conductors, 1 to 1-1/2 inches (2.54 cm to 1.28 cm) from each end, shall be suspended around a mandrel 5 times ± 1/2 times the outside diameter of the cable. A weight, as shown in Table 2 for the applicable size of the 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 °C ± 2 °C (212 °F ± 4 °F) for a minimum period of 120 hours ± 1 hour. 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% of the minimum number of oscillations specified in Table 2.

4.5.4 Impact (Shock)

Three 18-inch (45.7 cm) 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 °C ± 1 °C (160 °F ± 2 °F) for a minimum period of 72 hours ± 1 hour. 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 the cables shall be subjected to the following test.

4.5.4.2 Procedure

The impact shall consist of dropping a 23 pound ± 1 -0 pound (10.4 kg ± .4 kg) weight a distance of 6.5 inches ± 1/2 inch (16.5 cm ± 1.3 cm), 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 per minute ± 2 per minute. There shall be a continuous current of 3 A ± 1/2 A through size 18 and smaller conductors, 5 A ± 1/2 A through size 16, and 15 A ± 1/2 A 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 a series with adjacent conductors connected into the load circuit. The minimum number of shocks shall be not less than specified in Table 2 based on the average for three samples.

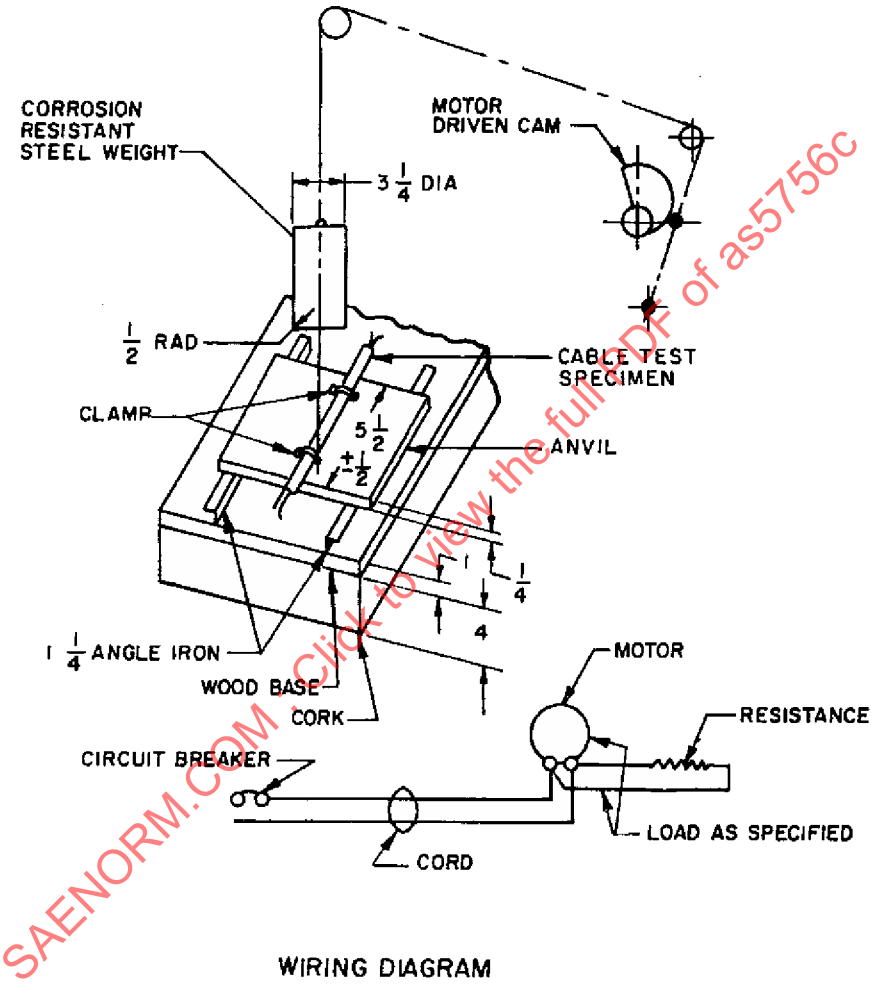

Figure 1 - Impact (shock)

4.5.5 Abrasion Test

Two untested samples 2.5 feet (76.2 cm) minimum in length shall be mounted securely at one end and weights as specified in Table 2 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 oscillations ± 2 oscillations per minute. The minimum number of oscillations to failure shall be as specified in Table 2. An oscillation shall consist of five bars travel forward and backward from a given point.

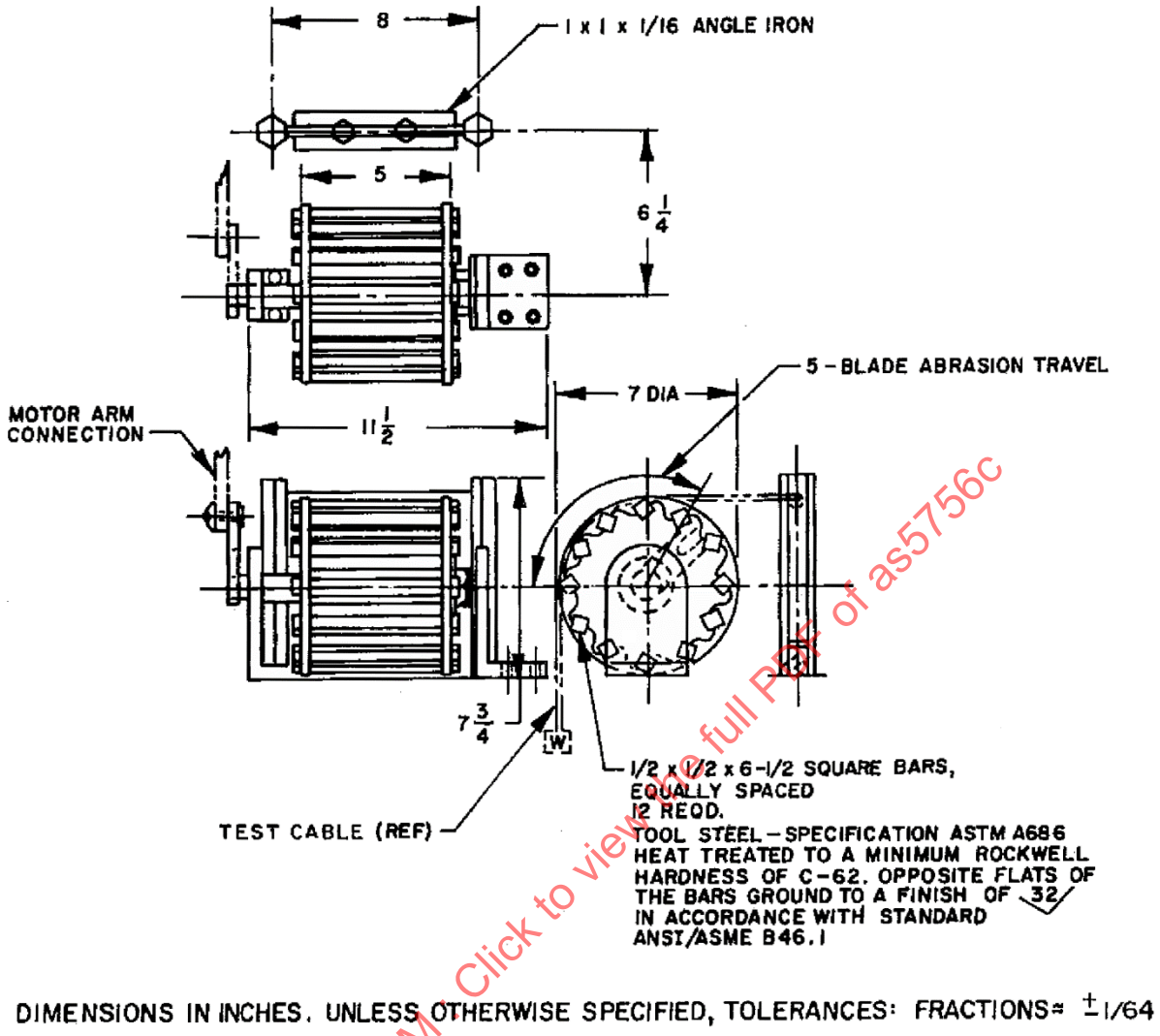

Figure 2 - Abrasion test apparatus

4.5.6 Fluid Immersion

Four individual samples 2.5 feet (76.2 cm) minimum in length shall be stripped to the bare conductor on either end for 1 inch (2.54 cm) and formed in a loop not less than five times the diameter of the cable. A minimum of 18 inches (45.7 cm) of the cable shall then be placed in each of the fluids specified in Table 4 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% of the minimum number of oscillations in Table 2.

Table 4 - Fluids

Fluid	Soak Time (Hours)	Air-Drying Time (Hours)
Hydrocarbon fluid (Specification ASTM D471, 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 D3699 and SAE J1966, grade 1100, respectively)	16	3

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 (61 cm) lengths of cable with the insulation, filler, and outer protective jacket, as applicable, removed for a distance of 1 inch (2.54 cm) from the ends of each specimen or each conductor in multi-conductor cable. Filler and outer jacket shall be removed from the stripped conductors of multi-conductor cable a minimum of 3 inches (7.62 cm) on each end.

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 (3.8 cm) of each end of the insulation will protrude above the surface of the water for a period of 4 hours. At the conclusion of the 4-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 Hz)
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 504 of AS4373 except the time of water immersion shall be 4 hours minimum. A direct-current potential of 100 to 500 V 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 supplier in the reported results.

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 °C ± 2 °C (-65 °F ± 3 °F) for 4 hours minimum. Upon the completion of the conditioning period and while still at -54 °C (-65 °F), the specimen shall be bent twice around a mandrel of a diameter five to seven times the outer diameter of the specimen within 24 seconds ± 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 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 (30.5 cm) on one end, shall be placed in a cold chamber and conditioned at -54 °C ± 2 °C (-65 °F ± 3 °F) for 4 hours minimum. Upon completion of the conditioning period and while still at -54 °C (-65 °F), the cable shall be placed on an anvil consisting of 3/8-inch (1 cm) steel plate and subjected to a 3 to 3-1/2 ft-lb (13.3 to 15.6 N) impact by dropping a weight having a ball-shaped end with a 1/2 inch ± 1/64 (1.3 ± .04 cm) inch radius through a tube at right angles to the specimen. Individual insulated conductors shall be subjected to a 0.25 to 0.31 ft-lb (1.1 to 1.4 N) 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 101 of AS4373.

4.5.11 Jacket Thickness

Measurement of thickness shall be made in accordance with Method 101 of AS4373.

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 (2.54 cm) or less diameter to be wrapped a minimum of five turns on the appropriate mandrel listed below and over 1.00 inch (2.54 cm) diameter cable to be wrapped a minimum of three turns on the appropriate mandrel listed below. Mandrel sizes are:

Specimen Diameter (Inches)	Mandrel Diameter (Inches)
0.0 to 0.500	3-1/2 to 4 ± 1/2 x specified diameter
0.501 to 0.750	4-1/2 to 5 ± 1/2 x specified diameter
0.751 to 1.250	5-1/2 to 6 ± 1/2 x specified diameter
1.251 to 1.750	7-1/2 to 8 ± 1/2 x specified diameter
1.751 and larger	9-1/2 to 10 ± 1/2 x specified diameter
Metric diameters may be determined based on 2.54 cm per inch.	

The specimens must be at room temperature for at least 1 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 70 °C (158 °F ± 5 °F) for 70 hours ± 0.5 hour and the specimens shall then be kept at room ambient for at least 4 days after removal from the aging oven and before the ozone test. The ozone test shall be conducted per ANSI/ASTM D1149 except for the chamber temperature shall be 38 °C ± 3 °C (100 °F ± 5 °F), the ozone concentration shall be 50 parts ozone ± 3 parts ozone per 100000000 parts of air, and the exposure time shall be 168 hours ± 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 403 of AS4373. The increase in conductor resistance per foot due to cabling in multi-conductor cables is incorporated into the conductor resistance values of the detail specifications.

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 A shall be impressed on each conductor and shown on an ammeter.