INCH-POUND

MIL-DTL-29606A
05 October 2010
SUPERSEDING
MIL-W-29606
30 August 1994

DETAIL SPECIFICATION

WIRE, ELECTRICAL, STRANDED, UNINSULATED COPPER, COPPER ALLOY, OR ALUMINUM, OR THERMOCOUPLE EXTENSION, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers concentric lay stranded and rope-lay stranded round electrical conductor fabricated from copper, copper alloy or aluminum. This specification also covers thermocouple extension conductor fabricated from nickel/chromium or nickel/aluminum/manganese. The conductors in this specification are suitable for use in insulated wires used in aerospace and other applications.

1.2 Classification. Stranded conductors are classified herein. The classifications are as follows:

Conductor Material	Conductor Stranding
Conductor Coating	Conductor Dimensions

1.2.1 Part or Identifying Number (PIN). PINS to be used for the wire acquired to this specification are created as follows:

M29606	-	20	-	SCC	-	GP
Basic Part No. (1.2.1.1)		Conductor Size (1.2.1.2)		Conductor Material and Coating (1.2.1.3)		Conductor Diameter Tolerance (1.2.1.4)

Comments, suggestions, or questions on this document should be addressed to: Naval Air Systems Command (Commander, Naval Air Warfare Center Aircraft Division, Code 4L8000B120-3, Highway 547, Lakehurst, NJ 08733-5100) or emailed to michael.sikora@navy.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST online database at https://assist.daps.dla.mil/.

The above conductor is a size 20 conductor of silver coated annealed copper conductor with general purpose diameter control.

1.2.1.1 Basic part number. The conductor military part number consists of the letter "M," the basic number of the applicable specification and the applicable alpha-numeric characters formulated in the example (see 1.2.1).

1.2.1.2 Conductor size. A one- or two-digit designator from table II is used to designate the conductor size.

1.2.1.3 Conductor material and coating designator. An alphabetic designator from table I is used to designate the conductor material and conductor coating.

1.2.1.4 Conductor diameter tolerance. The conductor diameter dimensional tolerance is designated as follows:

GP - General Purpose (see table II)
SD - Small Diameter (see table II)

Note: The GP conductors are inactive for new design for copper and copper alloy conductors. All conductors without a distinct diameter tolerance (GP or SD) are designated as general purpose (GP) diameter tolerance conductors.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications and standards. The following specification and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

FEDERAL STANDARD

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

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-202	-	Electronic and Electrical Component Parts
MIL-STD-2223	-	Test Methods for Insulated Electric Wire

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-C-3993	-	Copper and Copper-Base Alloy Mill Products; Packaging of

(Copies of the above specifications and standards are available online at https://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issue of these documents are the ones which are cited in the solicitation or contract (see 6.2).

AMERICAN SOCIETY FOR QUALITY

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ASQ-A8402	-	Quality Management and Quality Assurance – Vocabulary
ASQ Z1.4	-	Sampling Procedures and Tables for Inspection by Attributes

(Copies of this document are available from www.asq.org or American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

ASTM INTERNATIONAL

ASTM-A380	-	Steel Parts Equipment and Systems, Cleaning Descaling and Passivation of Stainless. (DoD adopted)
ASTM-B230/B230M	-	Aluminum 1350 - H19 Wire for Electrical Purposes. (DoD adopted)
ASTM-B263	-	Determination of Cross-Sectional Area of Stranded Conductors. (DoD adopted)
ASTM-B286	-	Copper Conductors for Use In Hookup Wire for Electronic Equipment. (DoD adopted)
ASTM-B298	-	Wire, Copper, Silver-Coated Soft or Annealed. (DoD adopted)
ASTM-B355	-	Nickel-Coated Soft or Annealed Copper Wire. (DoD adopted)
ASTM-B624	-	Wire Copper Alloy, High Strength, High Conductivity, for Electronic Application. (DoD adopted)

ASTM-B961	-	Standard Specification for Silver Coated Copper and Copper Alloy Stranded Conductors for Electronic Space Application.
ASTM-B965	-	Standard Specification for High Performance Tin-Coated Annealed Copper Wire Intended for Electrical and Electronic Application for Solderability.

(Copies of these documents are available from www.astm.org or ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI-MC96.1	-	Thermocouples Temperature Measurement. (DoD adopted)

(Copies of these documents are available from www.ansi.org or American National Standards Institute, 25 West 43rd Street, New York, NY 10036.)

GOVERNMENT ELECTRONICS AND INFORMATION TECHNOLOGY ASSOCIATION (GEIA)

EIA-557	-	Statistical Process Control Systems. (DoD adopted)

(Copies of this document are available from www.geia.org or Government Electronics and Information Technology Association, Standards & Technology Department, 2500 Wilson Boulevard, Arlington, VA 22201.)

NATIONAL CONFERENCE OF STANDARDS LABORATORIES INTERNATIONAL

NCSL-Z540	-	Laboratories, Calibration, and Measuring and Test Equipment. (DoD adopted)

(Copies of this document is available from www. www.ncsli.org the National Conference of Standards Laboratories International (NCSLI), 2995 Wilderness Place, Suite 107, Boulder, CO 80301.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related associated specifications), 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 Detail specification. The individual item requirements shall be as specified herein and in accordance with the ASTM or ANSI document when applicable. In the event of any conflict between requirements of this specification and the ASTM or ANSI standards (see 2.3), this specification shall govern.

3.1.1 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.3) in accordance with 4.5.

3.1.2 Statistical Process Control (SPC) for silver coated copper conductors. For silver coated copper conductors only, the manufacturer is required to establish and maintain an SPC system that meets the requirements of EIA-557 for control of silver coating circumferential non-uniformity (see 6.5.6) and local minimum silver coating thickness (see 6.5.7).

3.2 Conductor strand material. All strands used in conductors specified herein shall conform to the applicable ASTM or ANSI standards for the proper material listed in table I. After stranding conductor, strands shall be free from lumps, kinks, splits, scraped or corroded surfaces, and skin impurities. In addition, the strands shall conform to the following requirements as applicable.

3.2.1 Tin coated copper strands (type TCC). Tin coating shall be in accordance with ASTM-B965, except steam conditioning is not required for solderability testing.

3.2.2 Silver coated copper strands.

3.2.2.1 Type SCC. The strands shall have a coating thickness of not less than 40 microinches of silver when measured in accordance with ASTM-B298. No exposed copper shall be identified during magnification aided visual inspection of stranded conductor.

3.2.2.2 Type SCC1. The strands shall have a coating thickness of not less than 80 microinches of silver when measured in accordance with ASTM-B298. After stranding, the coating thickness on each of the individual conductor strands shall nowhere be less than 40 microinches of silver when inspected using micro-section analysis in accordance with ASTM-B961. No exposed copper shall be identified during magnification aided visual inspection of stranded conductor.

3.2.3 Nickel coated copper strands (type NCC). The strands shall have a coating thickness of not less than 50 microinches of nickel when measured in accordance with ASTM-B355.

3.2.4 Heavy nickel coated copper strands (type NHC). The copper strands shall have a coating thickness of not less than 27 percent by weight of nickel when measured in accordance with ASTM-B355.

3.2.5 Silver coated copper alloy strands.

3.2.5.1 Type SCA. The copper alloy strand base material shall conform to ASTM-B624. The strands shall have a coating thickness of not less than 40 microinches of silver when measured in accordance with ASTM-B298.

3.2.5.2 Type SCA1. The copper alloy strand base material shall conform to ASTM-B624. The strands shall have a coating thickness of not less than 80 microinches of silver when measured in accordance with ASTM-B298. After stranding, the coating thickness on each of the individual conductor strands shall nowhere be less than 40 microinches of silver when inspected using micro-section analysis in accordance with ASTM-B961.

3.2.6 Nickel coated copper alloy strands (type NCA). The copper alloy strand base material shall conform to ASTM-B624. The strands shall have a coating thickness of not less than 50 microinches of nickel when measured in accordance with ASTM-B355.

3.2.7 Heavy nickel coated copper alloy strands (type NHA). The copper alloy strand base material shall conform to ASTM-B624. The copper strands shall have a coating thickness of not less than 27 percent by weight of nickel when measured in accordance with ASTM-B355.

3.2.8 Silver coated ultra-high strength copper alloy strands (type SCU). The ultra-high strength copper alloy strands shall be made of a copper alloy material capable of meeting all requirements herein. The strands shall have a coating thickness of not less than 40 microinches of silver when measured in accordance with ASTM-B298.

3.2.9 Nickel coated ultra-high strength copper alloy strands (type NCU). The ultra-high strength copper alloy strands shall be made of a copper alloy material capable of meeting all requirements herein. The strands shall have a coating thickness of not less than 50 microinches of nickel when measured in accordance with ASTM-B355.

3.2.10 Aluminum strands (type ALU). The aluminum strand material shall conform to ASTM-B230/B230M.

3.2.11 Type K thermocouple extension conductor (type KPH, KPS, KNH, and KNS). Type KPH and KPS strands shall be made from an alloy of 90 percent nickel - 10 percent chromium. Type KNH and KNS strands shall be made from an alloy of 95 percent nickel - 2 percent aluminum - 2 percent manganese - 1 percent silicon and minor traces of other materials and shall conform to ANSI-MC96.1.

3.3 Conductor stranding. Conductor stranding shall be in accordance with tables II-A through II-F. No metallic coatings or platings are permitted over the stranded conductor after stranding.

3.3.1 Concentric stranding. The conductors with 7, 19, or 37 strands shall be concentric-lay stranded as specified in table II. The direction of lay shall be alternately reversed (true concentric lay) or in the same direction (unidirectional lay). The strands shall be assembled in a geometric arrangement of concentric layers, producing a smooth and uniform conductor, circular in cross-section and free of any crossovers of adjacent strands, high strands, or other irregularities. The direction of lay of the individual strands in the outer layer of the concentrically stranded conductors of the finished wire shall be left hand. The length of the outer layer shall be 8-16 times the maximum conductor diameter as specified in table II.

3.3.2 Rope-lay stranding. The conductors with more than 37 strands shall be rope-lay stranded as specified in table II. Rope-lay stranded conductors shall be laid up concentrically with a central member surrounded by one or more layers of helically wound members. The direction of lay of successive layers shall be alternately reversed (true concentric lay), or in the same direction (unidirectional lay). The length of the lay of the outer layer of rope-lay stranded conductor shall be 8-14 times the outside diameter of the completed conductor. The direction of lay of the outside layer shall be either left or right hand.

3.3.2.1 Rope-lay members. The individual members of the rope-lay stranded conductors may be either bunched or concentric stranded. The length of lay of the stranded members shall not be greater than 16 times the outside diameter of the member.

3.4 Splices. For conductor types TCC, SCC, SCC1, NCC, NHC, SCA, SCA1, NCA, NHA, SCU and NCU, splices in individual strands or members shall be butt brazed, or a similar process shall be used that does not damage the outer coating integrity. There shall not be more than one strand-splice in any two lay lengths of a stranded concentric-lay conductor or in any two lay lengths of any member in a rope-lay conductor, except that not more than one splice of the entire member shall be permitted in any two lay lengths of rope-lay conductor. Splices in members of a rope-lay construction shall be finished such that the conductor diameter is not increased at the point of joining. In no case shall the whole conductor be spliced at any one point.

For conductor type ALU, splices in individual strands shall not be closer than two lay lengths of member. Splices in members of rope-lay constructions shall not be closer than 10 feet. In no case shall the whole conductor be spliced at any one point.

For conductor types KPH, KPS, KNH, and KNS, splices in individual strands or groups of individual strands shall be butt brazed with silver solder. Splices shall be so constructed and disposed throughout the conductor that the diameter, configuration, conductor resistance, flexibility, and mechanical strength of the completed conductor are not adversely affected.

3.5 Properties of individual strands before stranding. The individual strands must comply with the ASTM or ANSI requirements, when applicable (see table I), and the plating thickness requirements for the specific conductor.

3.6 Properties of stranded conductors.

3.6.1 Conductor diameter. The diameter of the conductor shall be as specified in table II. Applicability of the "general purpose" or of the "small diameter" table II requirements for the maximum conductor diameter shall be as indicated by the part number. All measurements shall fall within the specified range. The diameter shall be measured in accordance with 4.7.2. All conductors without a distinct diameter tolerance (GP or SD) shall be designated as general purpose (GP) diameter tolerance conductors (see 1.2.1).

3.6.2 Solderability. The stranded conductor shall have a minimum coverage of 95 percent when examined after testing to the method specified in 4.7.3. Solderability requirements are not applicable to aluminum, thermocouple extension, or nickel coated conductors.

3.6.3 Elongation. The elongation of the entire conductor shall be measured on size 22 and smaller annealed copper, and all copper alloy conductors. Elongation measurements on single strands removed from the stranded constructions shall be measured on larger sizes of annealed copper and all sizes of aluminum. The minimum elongation shall be not less than the values in table II as measured in accordance with 4.7.4. Elongation requirements are not applicable to thermocouple extension conductors.

3.6.4 Tensile strength. The break strength of all copper alloy conductors shall be measured. The minimum break strength shall not be less than the values in table II. Tensile strength values of aluminum conductors shall be as specified in table II. There are no requirements for tensile strength on the annealed copper conductors and thermocouple extension conductors. The tensile strength or break strength shall be measured in accordance with 4.7.4.

3.6.5 Conductor resistance. The DC resistance of the conductor shall be not greater than the values in table II as measured in accordance with 4.7.5. In addition, for thermocouple extension conductors only, the DC resistance of the conductor shall be greater than the minimum values in table II as measured in accordance with 4.7.5.

3.6.5.1 Electromotive force (thermocouple extension conductor only). The temperature-electromotive force relationship of the type K positive and negative legs formed together as a thermocouple shall conform to requirements of ANSI-MC96.1 for type K compositions when measured in accordance with 4.7.5.1.

3.6.6 Continuity of coating. For all coated conductors, the coating on the strands shall be continuous in accordance with the applicable ASTM requirement (ASTM-B286, ASTM-B355 or ASTM-B965).

3.6.6.1 Coating workmanship examination. For workmanship examination of the coating follow procedures in 4.7.6. A specimen is considered to have failed if exposed copper is revealed due to the stranding operation or as a pre-existing condition prior to stranding.

3.6.6.2 Continuity of nickel and tin coatings. For nickel and tin coatings, only continuity of coating shall also be based on requirements in ASTM-B965 and ASTM-B355. If a sodium polysulfide test is required, follow test procedures in 4.7.6.1 A specimen is considered to have failed if blackening due to exposed copper is revealed due to the stranding operation or as a pre-existing condition prior to stranding. The failures fall into one or both of the following categories:

a. Failure on one strand due to a defective condition in the strand prior to the stranding process; e.g., scraped single strand. This type of fault appears to the unaided eye as a spiral blackening around the conductor.

b. Failure along one side of the sample due to excessive, local abrasion to that side during stranding. This type of failure appears to the unaided eye as a continuous blackening along the axis of the conductor.

3.6.7 Cross-sectional area. The minimum cross-sectional area of the stranded conductor shall conform with the table II requirements, as measured in accordance with 4.7.7.

3.7 Disposal of in-process waste. Caution must be taken during any plating, cleaning, descaling, passivation, or similar process. The contractor shall be responsible for the safe re-utilization and disposal of all material generated by these processes in accordance with ASTM-A380.

4. VERIFICATION

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

a. Strand inspection (see 4.4).

b. First article inspection (see 4.5).

c. Conformance inspections (see 4.6).

4.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities shall be established and maintained by the contractor. 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.

4.3 Statistical Process Control. An SPC program shall be established and maintained in accordance with EIA-557 for the control of two product characteristics, coating circumferential non-uniformity (see 6.5.6) and local minimum coating thickness (see 6.5.7) on silver coated conductors. When required by the procuring activity, evidence of SPC methodologies in use shall be provided for review.

4.3 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in The General Requirements of FED-STD-228.

4.4 Strand inspection. When required by the procuring activity, strand inspection shall consist of certification to the ASTM or ANSI standard when applicable (see table I), verification of coating thickness (if applicable), and any additional inspections required to ensure the strands meet the requirements of the individual strand specification (if applicable).

4.4.1 Coating thickness. Coating thickness of nickel and silver coating strands shall be measured in accordance with the ASTM-B355 and ASTM-B298 test procedures respectively.

4.4.1.1 Coating thickness of material types SCC, SCC1, SCA, SCA1, and SCU. For silver coated material types SCC, SCC1, SCA, SCA1, and SCU, statistical process control methodology in accordance with EIA-557 shall be applied for control of circumferential non-uniformity (see 6.5.6) and local minimum coating thickness (see 6.5.7). The SPC program shall be designed to improve circumferential non-uniformity and local minimum coating thickness measurements so that these trend away from the occurrence of thin or voided silver.

4.4.1.2 Coating thickness of material types SCC1 and SCA1. For silver coated material types SCC1 and SCA1, micro-section inspection samples shall be prepared in accordance with ASTM-B961. Micro-section inspections shall be in accordance with ASTM-B961, except that the coating thicknesses specified herein shall be in effect (see 3.2.2.1 and 3.2.2.2). When required by the procuring activity, photographs shall be captured and saved as proof of inspection. The magnification scale of photographs shall be identified.

4.5 First article inspection. First article inspection shall consist of verification of all requirements specified herein, including all examinations and tests specified in 4.7. First article inspection shall include the solderability test on silver coated conductors (see 4.7.3.1 and 6.2g).

4.5.1 First article acceptance criteria. Failure to meet the requirements specified herein shall be cause for rejection of the first article sample. Acceptance or rejection of the first article sample will be based on the objective quality evidence and as defined in ASQC-A8402.

4.6 Quality conformance inspection. Quality conformance inspection shall consist of all tests specified in 4.7 and shall be performed on every lot of conductors purchased in accordance with this specification.

4.6.1 Sampling for visual and dimensional inspection. From each lot (see 6.5.2), sample units (see 6.5.4) shall be selected at random in accordance with ASQ Z1.4. The inspection level shall be S-2 unless otherwise specified in the ordering data (see 6.2h). No allowance will be made for defects.

4.6.2 Sampling for performance inspection. From each lot, sample units shall be selected at random in accordance with ASQ Z1.4. The inspection level shall be S-2 unless otherwise specified in the ordering data (see 6.2h).

4.6.3 Inspection of packaging. The sampling and inspection of the preservation, packaging, and container marking shall be in accordance with the requirements of MIL-C-3993.

4.7 Test methods.

4.7.1 Visual examination. The conductor shall be visually inspected to determine conformance to the conductor strand materials requirements and any other requirements herein not covered by specified test methods.

4.7.2 Diameter. The diameter shall be measured at three locations along the length of each sample. Each measurement shall be the average of two readings taken 90 degrees apart on the conductor. Micrometers, calipers, or optical measurement devices capable of reading to the nearest 0.0001 inch for sizes 12 and smaller or to the nearest 0.001 inch for sizes 10 and larger shall be used.

4.7.3 Solderability. Samples shall be tested per MIL-STD-202, Method 208 except as noted below, according to the plating/coating material and base material, as applicable.

4.7.3.1 Silver coated conductor. Exceptions to MIL-STD-202, Method 208:

a. Wrapping wire is not necessary.

b. For first article tests, the test shall require steam aging as specified in MIL-STD-202, Method 208. For conformance testing, no steam aging is required.

4.7.3.2 Tin coated conductor. Exceptions to MIL-STD-202, Method 208:

a. Wrapping wire is not necessary.

b. Steam aging shall not be required.

4.7.3.3 Nickel coated conductor. No solderability testing is required for nickel coated conductors.

4.7.3.4 Aluminum conductor. No solderability testing is required for aluminum conductors.

4.7.3.5 Thermocouple extension conductor. No solderability testing is required for thermocouple conductors.

4.7.4 Conductor elongation, tensile strength, and break strength.

4.7.4.1 Soft or annealed copper. Elongation tests of soft or annealed copper conductors shall be performed in accordance with MIL-STD-2223, Method 5002, except that the elongation at break of the individual strand or of the first strand of the whole conductor, as applicable, shall be determined by means of a recording chart, or other means, on the testing machine rather than by measuring the specimen after the break. For sizes 22 and smaller, the tests shall be performed upon the whole conductor and the elongation measured when the first strand of the conductor breaks. For conductors larger than 22, strands shall be carefully removed from the conductor and tested for elongation. Tensile or break strength measurements are not required for annealed copper conductors.

4.7.4.2 High strength copper alloy. Elongation and tensile strength tests of high strength copper alloy conductors shall be performed in accordance with MIL-STD-2223, Method 5002, except that the grip separation speed shall be 2 inches per minute. The tensile strength (reported as the tensile breaking strength of the conductor rather than in pounds per square inch) and elongation at the break of the individual strand or of the first strand of the whole conductor, as applicable, shall be determined by the means of a recording chart, or other means, on the testing machine. Tests shall be performed upon the whole conductor and the break strength and elongation measured when the first strand of the conductor breaks.

4.7.4.3 Aluminum conductors. Elongation and tensile strength tests of aluminum conductors shall be performed in accordance with MIL-STD-2223, Method 5002. A sample of single strands shall be carefully removed from the conductor and tested for tensile strength and elongation.

4.7.5 Conductor resistance. The DC resistance of the conductor shall be measured in accordance with MIL-STD-2223, Method 5003, except that the wire shall be tested dry without immersion.

4.7.5.1 Electromotive force (thermocouple extension only). A thermocouple shall be formed between the positive and negative leg conductors from a sample taken from each coil or reel to be supplied in the contract or purchase order. The electromotive force characteristics of the wire shall be determined at 0 °C, 200 °C, 400 °C, 600 °C, 800 °C, and 1000 °C.

The electromotive force characteristics shall meet the following tolerances:

LIMITS OF ERROR FOR THERMOCOUPLE

Thermocouple Range °C	Standard Limits (Whichever is greater)	Special Limits (Whichever is greater)
0 to 1250 °	+2.2 °C or ±0.75% xT	±1.1 °C or ±0.4% xT

Where T = Test temperature

4.7.6 Continuity of coating. Continuity of coating inspection shall be in accordance with ASTM B286 examination for workmanship of finished uninsulated stranded conductor. Optical magnification employed during inspection shall be at least 10x and up to 20x to referee suspect exposed copper locations. A white background shall be used for the inspection. Inspection for exposed copper shall be performed using stranded conductor material not less than 12 inches in length.

4.7.6.1 Continuity of coating – nickel and tin coated conductors only. For nickel and tin coated conductors only, follow procedures for sodium polysulfide test in accordance with the applicable ASTM requirement (ASTM-B965 and B355) with the following exceptions:

NOTE: The ASTM polysulfide test applies to single-end wires "taken before stranding" (see for example, ASTM-B355). The applicability of the polysulfide test is thus restricted by the ASTM in recognition of the abrasion to the wire inherent in the stranding process. The following exceptions and criteria shall be applied when testing stranded product:

a. Examination of the samples shall be immediately after the solution cycle.

b. Samples shall be immersed into the solutions in the as-stranded condition.

- Unilay constructions shall be tested as the whole conductor.
- Concentric constructions shall be tested as the whole conductor.

- Two members from each layer of rope constructions shall be tested after they have been carefully removed from the finished rope.

4.7.7 Cross sectional area. The stranded conductor shall be tested according to ASTM-B263. Use K-values given in table II. If no K-value is given, then use K=0.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. Wires covered by this specification are intended to be used for electrical conductors in insulated wires. These wires are required to withstand extreme environments not present in commercial applications.

6.1.1. Metric cross-reference tables. Soft metric conversions provided in tables III-A, III-B, III-C, III-D, III-E, and III-F provides a cross reference for corresponding titled tables II-A, II-B, II-C, II-D, II-E, and II-F for information.

6.1.2 Red plague. Silver plated copper wire is susceptible to red plague; a galvanic corrosion reaction between silver and copper that occurs when the copper substrate (conductor) is exposed to oxygen and moisture, see AIR-4487 for mitigation techniques.

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Part number (see 1.2.1).

c. Quantity of conductor required.

d. Inspection conditions and classification of inspection, if other than specified (see 4.2 and 4.3).

e. Additional strand inspection/requirements (see 4.4).

f. If evidence of SPC methodology, a first article test report, or photographs are required (see 4.3, 4.4.1, 4.5).

g. Inspection level (see 4.5).

h. Requirement for first article inspection, if necessary (see 3.1.1 and 6.4).

i. Packaging requirements (see 5.1).

6.3 First article inspection. When first article inspection is required, the contracting officer should provide specific guidance to offerors whether the item(s) should be a first article sample, a first production item, or a standard production item from the contractor’s current inventory and the number of items to be tested as specified in 4.5. The contracting officer should include

specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Conductor cross-sectional area. The conductor cross-sectional area is expressed as a Circular Mill Area (CMA) value. One circular mill is equal to the area of a circle with a diameter of .001 inch (1 mil). The nominal CMA was determined by calculating the CMA of a single strand and multiplying it by the number of strands in the conductor. The minimum CMAs were determined by different methods depending on the wire size. For sizes 8 and larger, the minimum strand size from the ASTM for the strand was determined and the minimum strand CMA calculated. The minimum strand CMA was multiplied by the number of strands excluding allowable missing strands, to obtain the minimum CMA of the stranded conductor. The values for sizes 10 and smaller were set lower than that required by the ASTM minimum strand size and higher than that required by the maximum conductor resistance requirements. Other factors considered included military specification insulated wire weight and conductor diameter requirements. The K-values needed to calculate the CMAs from the stranded conductor weights were calculated by the Naval Air Warfare Center Aircraft Division, Indianapolis, based on the conductor stranding requirements, including length of lay, in this specification.

6.5 Definitions.

6.5.1 Concentric lay. Concentric lay is defined as a central strand surrounded by one or more layers of helically wound strands.

6.5.2 Lot. All the stranded conductors of one part number made under the same essential conditions, produced on a substantially continuous basis, and offered for inspection at one time are considered a lot for purposes of sampling.

6.5.3 Sample. The sample is the group of sample units selected from the lot for the purpose of inspection.

6.5.4 Sample unit. The sample unit consists of a single piece of finished conductor of sufficient length to permit all applicable examinations and tests. Not more than one sample unit for each group of tests should be taken from a single unit of product.

6.5.5 Unit of product. A unit is one continuous length of conductor.

6.5.6 Circumferential non-uniformity. Circumferential non-uniformity is a measurement that represents coating thickness inconsistency around the circumference of conductor strands. It is inspected using a cross section of stranded conductor material and measuring at the location where the distance between the generally smooth, outer coating surface and the copper substrate is most thin. Local anomalies (scratches, etc.) that may further reduce the coating thickness below the generally smooth outer surface are ignored for this measurement. Measurement of this characteristic and statistical tracking over time is intended to improve coating uniformity, to reduce the occurrence of thin coating on one side and thickened coating opposite. Ideally, the coating is uniformly thick all around so that this measurement is close to the average coating thickness targeted for the product.

6.5.7 Local minimum coating thickness. The local minimum coating thickness is a measurement that represents localized phenomena which reduce coating thickness. It is inspected using a cross section of stranded conductor material and measuring at the location where the coating is most thin. Local anomalies (scratches, etc.) that reduce the coating thickness below the generally smooth outer surface must be considered for this measurement. Measurement of this characteristic and statistical tracking over time is intended to reduce the occurrence of locally thinned coating. Ideally, there are few local coating thickness reductions viewable for measurement and they do not penetrate deep into the coating.

6.6 Subject term (key word) listing.

Concentric
Conductor
Rope lay
Stranding

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

TABLE I. Conductor strand material and coating.

Designator	Strand material	Coating	Application ASTM or ANSI standard
SCC	Annealed copper	Silver	ASTM-B298
SCC1	Annealed copper	Silver	ASTM-B298 ASTM-B961
SCA	High strength copper alloy 1/	Silver	ASTM B298 ASTM-B624
SCA1	High strength copper alloy 1/	Silver	ASTM B298 ASTM-B624 ASTM-B961
SCU	Ultra-high strength copper alloy 1/	Silver	None
NCC	Annealed copper	Nickel	ASTM-B355
NCA	High strength copper alloy 1/	Nickel	ATSM-B624
NCU	Ultra-high strength copper alloy 1/	Nickel	None
NHC	Annealed copper	Nickel (27%)	ASTM-B355
NHA	High strength copper alloy 1/	Nickel (27%)	ASTM-B624
TCC	Annealed copper	Tin	ASTM-B965
ALU	Aluminum 1350-H19 (extra hard)	None	ASTM-B230/230M
KPH	Special limits Type K - thermocouple extension nickel/chromium (positive leg)	None	ANSI-MC96.1
KPS	Special limits Type K - thermocouple extension nickel/chromium (positive leg)	None	ANSI-MC96.1
KNH	Special limits Type K - thermocouple extension nickel/chromium (negative leg)	None	ANSI-MC96.1
KNS	Special limits Type K - thermocouple extension nickel/chromium (negative leg)	None	ANSI-MC96.1

1/ High strength and ultra-high strength copper alloy conductors have a higher conductor resistance (lower conductivity) than annealed copper conductors of the same size.

TABLE II-A. Details of annealed copper conductors.

Size designation	Conductor area (circular mils)		K-value	Stranding (no. of strands X AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia. of individual strands (Inch) 1/	Diameter of Stranded Conductor					Max resistance of conductor (ohms/1000 ft at 20 °C)			Elongation (% Min)
							Min (Inch)	Max (Inch)							
								Sm dia		Gen'l purpose					
	Nominal 2/ (all)	Minimum						(SCC/ SCC1)	(NCC/ TCC)	(SCC/ SCC1)	(NCC/ TCC)	Silver coated (SCC/ SCC1)	Nickel coated (NCC)	Tin coated (TCC)	
30	112	102	.77	7x38	0	0.0040	0.0105	0.0124	0.0134	0.0124	0.0134	100.7	110.7	108.4	6
28	175	161	1.05	7x36	0	0.0050	0.0135	0.0154	0.0164	0.0154	0.0164	63.8	67.9	68.6	6
26	304	275	1.34	19x38	0	0.0040	0.0175	0.0194	0.0204	0.0204	0.0214	38.4	42.2	41.3	6
24	475	434	1.18	19x36	0	0.0050	0.0225	0.0244	0.0244	0.0254	0.0264	24.3	25.9	26.2	6
22	754	694	1.87	19x34	0	0.0063	0.0285	0.0304	0.0314	0.0324	0.0334	15.1	16.0	16.2	10
20	1,216	1,127	1.34	19x32	0	0.0080	0.0365	0.0384	0.0394	0.0404	0.0414	9.19	9.77	9.88	10
18	1,900	1,770	1.34	19x30	0	0.0100	0.0455	0.0484	0.0494	0.0504	0.0514	5.79	6.10	6.23	10
16	2,426	2,261	1.19	19x29	0	0.0113	0.0515	0.0544	0.0554	0.0574	0.0584	4.52	4.76	4.81	10
14	3,831	3,570	1.38	19x27	0	0.0142	0.0645	0.0684	0.0694	0.0724	0.0734	2.88	3.00	3.06	10
12 1/	6,088	5,672	1.67	19x25	0	0.0179	0.0815	0.0854	0.0864	0.0904	0.0924	1.81	1.89	1.92	10
12 1/	5,874	5,473	1.26	37x28	0	0.0126	0.0835	0.0874	0.0894	0.0894	0.0904	1.90	1.98	2.02	10
10	9,354	8,716	1.35	37x26	0	0.0159	0.106	0.110	0.112	0.112	0.114	1.19	1.24	1.26	10
8 3/	16,983	16,645	2.29	133x29	0	0.0113	0.158	0.166	0.169	0.169	0.173	0.658	0.694	0.701	10
6 3/	26,818	26,284	2.31	133x27	0	0.0142	0.198	0.208	0.212	0.213	0.217	0.418	0.436	0.445	10
4 3/	42,615	41,767	2.55	133x25	0	0.0179	0.250	0.263	0.268	0.268	0.274	0.264	0.275	0.280	10
2 3/	66,500	64,981	3.21	665x30	2	0.0100	0.320			0.340	0.340	0.170	0.177	0.183	10
1 3/	81,700	79,878	2.89	817x30	2	0.0100	0.360			0.380	0.380	0.139	0.144	0.149	10
01 3/	104,500	102,126	3.24	1,045x30	3	0.0100	0.395			0.425	0.425	0.108	0.113	0.116	10
02 3/	133,000	130,059	3.15	1,330x30	3	0.0100	0.440			0.475	0.475	0.085	0.089	0.091	10
03 3/	166,500	162,795	3.09	1,665x30	4	0.0100	0.500			0.540	0.540	0.068	0.071	0.071	10
04 3/	210,900	206,213	3.32	2,109x30	5	0.0100	0.565			0.605	0.605	0.054	0.056	0.056	10

1/ For size 12, 37x28 is the preferred constructions. 19x25 is inactive for new design.
2/ Nominal values are for information only. Nominal values are not requirements.
3/ SCC1 conductors are limited to 30 - 10 AWG sizes.

TABLE II-B. Details of aluminum conductors.

Size desig-nation	Conductor area (circular mils)		Stranding (no. of strands X AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia. of individual strands (Inch) 1/	Diameter		Max resistance (ohms per 1000 @ 20 °C)	Tensile (KSI)	Elongation (% min)
	Nominal 1/	Minimum				Min (Inch)	Max (Inch)			
8	16,564	15,571	41x24	0	0.0201	0.150	0.160	1.093	23 - 35	1
6	28,280	26,891	70x24	0	0.0201	0.201	0.211	0.641	23 - 35	1
4	43,229	41,105	107x24	0	0.0201	0.248	0.262	0.427	23 - 35	1
2	67,874	63,771	168x24	2	0.0201	0.315	0.330	0.268	23 - 35	1
1	88,478	83,363	219x24	2	0.0201	0.353	0.368	0.214	23 - 35	1
01	104,639	98,345	259x24	3	0.0201	0.400	0.418	0.169	23 - 35	1
02	134,939	127,157	334x24	3	0.0201	0.454	0.478	0.133	23 - 35	1
03	172,512	162,500	427x24	4	0.0201	0.511	0.535	0.109	23 - 35	1
04	211,297	198,995	523x24	5	0.0201	0.563	0.587	0.085	23 - 35	1

1/ Nominal values are for information only. Nominal values are not requirements.

TABLE II-C. Details of high strength copper alloy conductors.

Size designation	Conductor area (circular mils)		K-value	Stranding (no. of strands X AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia. of individual strands (Inch) 1/	Diameter of stranded conductor					Max resistance of conductor (ohms/1000 ft at 20 °C)		Min breaking strength (lbs) (SCA/ SCA1/ NCA)	Elongation (% min)
								Max (Inch)							
								Sm dia		Gen'l purpose					
	Nominal 1/ (all)	Minimum					Min (Inch)	(SCA/ SCA1)	(NCA)	(SCA/ SCA1)	(NCA)	Silver Coated (SCA/ SCA1)	Nickel Coated (NCA)		
30	112	102	.77	7x38	0	0.0040	0.0105	0.0124	0.0134	0.0124	0.0134	117.4	129.6	5.2	6
28	175	161	1.05	7x36	0	0.0050	0.0135	0.0154	0.0164	0.0154	0.0164	74.4	79.0	8.2	6
26	304	275	1.34	19x38	0	0.0040	0.0175	0.0204	0.0204	0.0204	0.0214	44.8	49.4	14.2	6
24	475	434	1.18	19x36	0	0.0050	0.0225	0.0244	0.0254	0.0254	0.0264	28.4	30.1	22.4	6
22	754	694	1.87	19x34	0	0.0063	0.0285	0.0314	0.0314	0.0324	0.0334	17.5	18.6	35.8	6
20	1,216	1,127	1.34	19x32	0	0.0080	0.0365	0.0395	0.0404	0.0404	0.0414	10.7	11.4	58.1	6
18	1,900	1,770	1.34	19x30	0	0.0100	0.0465	0.0467	0.0467	0.0504	0.0514	6.43	6.79	90.3	6
16	2,426	2,261	1.19	19x29	0	0.0113	0.0515	0.0530	0.0530	0.0574	0.0584	4.90	5.16	115	6

1/ Nominal values are for information only. Nominal values are not requirements.

TABLE II-D. Details of 27% nickel coated (NHC/NHA) conductor.

Size desig-nation	Conductor area (circular mils)		K-value	Stranding (no of strands X AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia. of individual strands (Inch) 1/	Minimum diameter of stranded conductor (Inch)	Maximum diameter of stranded conductor (Inch)	Max resistance of conductor (ohms/1000 ft at 20 °C		Elongation (%, Min)	
	Nominal (all) 1/	Minimum							(NHC)	(NHA)	(NHC)	(NHA)
22	754	694	1.87	19x34	0	0.0063	0.0290	0.0336	23.7	25.6	10	6
20	1,216	1,127	1.34	19x32	0	0.0080	0.0365	0.0415	14.6	15.3	10	6
18	1,900	1,770	1.34	19x30	0	0.0100	0.0455	0.0520	9.14	9.59	10	6
16	2,426	2,261	1.19	19x29	0	0.0113	0.0520	0.0610	6.85	7.30	10	6
14	3,831	3,570	1.38	19x27	0	0.0142	0.0650	0.0740	4.32		10	
12	6,088	5,672	1.67	19x25	0	0.0179	0.0820	0.0940	2.78		10	
10	9,880	8,716	1.35	49x27	0	0.0142	0.123	0.129	1.68		10	
8	16,983	16,645	2.29	133x29	0	0.0113	0.158	0.179	0.936		10	
6	26,818	26,284	2.31	133x27	0	0.0142	0.198	0.218	0.591		10	
4	42,615	41,767	2.55	133x25	0	0.0179	0.250	0.272	0.375		10	
2	66,500	64,981	3.21	665x30	2	0.0100	0.320	0.345	0.241		10	
1	81,700	79,878	2.89	817x30	2	0.0100	0.355	0.384	0.196		10	
01	104,500	102,126	3.24	1,045x30	3	0.0100	0.395	0.432	0.153		10	
02	133,000	130,059	3.15	1,330x30	3	0.0100	0.440	0.490	0.120		10	
03	166,500	162,795	3.09	1,665x30	4	0.0100	0.500	0.548	0.096		10	
04	210,900	206,213	3.32	2,109x30	5	0.0100	0.565	0.615	0.077		10	

1/ Nominal values are for information only. Nominal values are not requirements.

TABLE II-E. Details of ultra-high strength copper alloy conductors.

Size designation	Conductor area (Circular Mils)		K-value	Stranding (no. of strands X AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia. of individual strands (Inch) 2/	Diameter of stranded conductor		Maximum resistance (ohms/ 1000 ft) at 20 °C Nickel Coated NCU	Maximum resistance (ohms/ 1000 ft) at 20 °C Silver coated SCU	Min break strength (lbs)	Elongation (% min)
	Nominal 2/	Minimum					Min (Inch)	Max (Inch)				
26	304	275	1.34	19x38	0	0.0040	0.0175	0.0204	58.4	56.4	21.5	6

1/ Applies to silver and nickel coated conductors, unless otherwise noted.
2/ Nominal values are for information only. Nominal values are not requirements.

TABLE II-F. Details of Type KPH, KPS, KNH and KNS extension conductors.

Size desig-nation	Conductor area (circular mils)		Stranding (no. of strands x AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia of individual strands (Inch) 1/	1/ General purpose conductor diameter		Resistance (ohms Per 1000 ft@ 20°C)			
								KP (H or S)		KN (H or S)	
	Nominal	Minimum				Min (Inch)	Max (Inch)	Min.	Max.	Min.	Max.
22	754	694	19x34	0	0.063	0.029	0.033	546.7	604.3	228.2	252.3
20	1,216	1,127	19x32	0	0.0080	0.037	0.041	339.2	375.0	141.5	156.5
18	1,900	1,770	19x30	0	0.100	0.046	0.051	217.0	240.0	90.5	100.2
16	2,426	2,261	19x29	0	0.113	0.052	0.058	169.7	187.7	70.6	78.2
14	3,831	3,570	19x27	0	0.142	0.065	0.073	107.6	119.0	44.9	49.7

1/ No small diameter thermocouple conductors exist at this time.

TABLE III-A. Details of annealed copper conductors (soft metric conversion).

Size designation	Conductor Area (m^2)		K-value	Stranding (no. of strands X AWG of strands)	Allowable mo. of missing strands (max)	Nominal dia. of individual strands (mm) 1/	Diameter of stranded conductor					Max Resistance of Conductor (ohms/km at 20 °C) Soft or Annealed Copper			Elongation (% min)
							Min (mm)	Max (mm)							
								Sm dia		Gen'l purpose					
	Nominal 2/ (all)	Minimum						(SCC/ SCC1)	(NCC/ TCC)	(SCC/ SCC1)	(NCC/ TCC)	Silver coated (SCC/ SCC1)	Nickel coated (NCC)	Tin coated (TCC)	
30	0.0568	0.0517	.77	7x38	0	0.102	0.267	0.315	0.340	0.315	0.340	330.4	363.2	355.6	6
28	0.0887	0.0816	1.05	7x36	0	0.127	0.343	0.391	0.417	0.391	0.417	209.3	222.8	225.1	6
26	0.1540	0.1393	1.34	19x38	0	0.102	0.445	0.493	0.518	0.518	0.544	126.0	138.5	133.5	6
24	0.2407	0.2199	1.18	19x36	0	0.127	0.572	0.620	0.620	0.645	0.671	79.7	85.0	86.0	6
22	0.3821	0.3517	1.87	19x34	0	0.160	0.724	0.772	0.798	0.823	0.848	49.5	52.5	53.1	10
20	0.6162	0.5711	1.34	19x32	0	0.203	0.927	0.975	1.00	1.03	1.05	30.2	32.1	32.4	10
18	0.9627	0.8969	1.34	19x30	0	0.254	1.16	1.23	1.25	1.28	1.31	19.0	20.0	20.4	10
16	1.229	1.146	1.19	19x29	0	0.287	1.31	1.38	1.41	1.46	1.48	14.8	15.6	15.8	10
14	1.941	1.809	1.38	19x27	0	0.361	1.64	1.74	1.76	1.84	1.86	9.45	9.84	10.0	10
12 1/	3.085	2.874	1.67	19x25	0	0.455	2.07	2.17	2.19	2.30	2.35	5.97	6.20	6.30	10
12 1/	2.976	2.773	1.26	37x28	0	0.320	2.12	2.22	2.27	2.27	2.30	6.23	6.50	6.63	10
10	4.740	4.416	1.35	37x26	0	0.404	2.69	2.79	2.84	2.84	2.90	3.90	4.07	4.13	10
8 3/	0.605	8.434	2.29	133x29	0	0.287	4.01	4.22	4.29	4.29	4.39	2.16	2.28	2.30	10
6 3/	13.59	13.32	2.31	133x27	0	0.361	5.03	5.28	5.38	5.41	5.51	1.37	1.43	1.46	10
4 3/	21.59	21.16	2.55	133x25	0	0.455	6.35	6.68	6.81	6.81	6.96	0.866	0.902	0.919	10
2 3/	33.70	32.92	3.21	665x30	2	0.254	8.13			8.64	8.64	0.558	0.581	0.600	10
1 3/	41.40	40.47	2.89	817x30	2	0.254	9.14			9.65	9.65	0.456	0.472	0.489	10
01 3/	52.95	51.75	3.24	1,045x30	3	0.254	10.0			10.8	10.8	0.354	0.371	0.381	10
02 3/	67.39	65.90	3.15	1,330x30	3	0.254	11.2			12.1	12.1	0.279	0.292	0.299	10
03 3/	84.37	82.49	3.09	1,665x30	4	0.254	12.7			13.7	13.7	0.223	0.233	0.233	10
04 3/	106.84	104.49	3.32	2,109x30	5	0.254	14.4			15.4	15.4	0.177	0.184	0.184	10

1/ For size 12, 37x28 is the preferred construction. 19x25 is inactive for new design.
2/ Nominal values are for information only. Nominal values are not requirements.
3/ SCC1 conductors are limited to limited to 30 - 10 AWG sizes.

THIS SOFT METRIC CONVERSION TABLE III-A PROVIDES A CROSS-REFERENCE TO TABLE II-A.
FOR INFORMATION ONLY

TABLE III-B. Details of aluminum conductors (soft metric conversion).

Size desig-nation	Cross-sectional area (mm^2)		Stranding (no. of strands X AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia. of individual strands (mm) 1/	Diameter of stranded conductor		Max resistance (ohms/km @ 20 °C)	Tensile strength (n/mm^2)	Elongation (%, Min)
	Nominal 1/	Minimum				Min (mm)	Max (mm)			
8	8.39	7.98	41x24	0	0.0511	3.81	4.06	3.586	158-241	1
6	14.33	13.62	70X24	0	0.0511	5.11	5.36	2.103	158-241	1
4	21.90	20.82	107x24	0	0.0511	6.30	6.65	1.401	158-241	1
2	34.39	32.31	168x24	2	0.0511	8.00	8.38	0.879	158-241	1
1	44.83	42.24	219x24	2	0.0511	8.97	9.35	0.702	158-241	1
01	53.02	49.83	259x24	3	0.0511	10.2	10.6	0.554	158-241	1
02	68.37	64.43	334x24	3	0.0511	11.5	12.1	0.436	158-241	1
03	87.41	82.34	427x24	4	0.0511	13.0	13.6	0.358	158-241	1
04	107.07	100.83	523x24	4	0.0511	14.3	14.9	0.279	158-241	1

1/ Nominal values are for information only. Nominal values are not requirements.

THIS SOFT METRIC CONVERSION TABLE III-B PROVIDES A CROSS-REFERENCE TO TABLE II-B.
FOR INFORMATION ONLY

TABLE III-C. Details of high strength copper alloy conductors (soft metric conversion).

Size designation	Cross-sectional area (mm^2)		K-value	Stranding (no. of strands X AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia. of individual strands (mm) 1/	Diameter of stranded conductor					Max resistance of conductor (ohm/ km at 20 °C)		Min breaking strength (Kgs) (SCA/ SCA1/ NCA)	Elongation (% Min)
							Min (mm)	Max (mm)							
								Sm dia		Gen'l purpose					
	Nominal 1/ (all)	Minimum						(SCA/ SCA1)	(NCA)	(SCA/ SCA1)	(NCA)	Silver Coated (SCA/ SCA1)	Nickel Coated (NCA)		
30	0.0568	0.0517	0.77	7x38	0	0.102	0.267	0.315	0.340	0.315	0.340	385.2	425.2	2.3	6
28	0.0887	0.0816	1.05	7x36	0	0.127	0.343	0.391	0.417	0.391	0.417	244.1	259.2	3.7	6
26	0.1540	0.1393	1.34	19x38	0	0.102	0.445	0.518	0.518	0.518	0.544	147.0	162.1	6.4	6
24	0.2407	0.2199	1.18	19x36	0	0.127	0.572	0.620	0.645	0.645	0.671	93.2	98.8	10.2	6
22	0.3821	0.3517	1.87	19x34	0	0.160	0.724	0.798	0.798	0.823	0.848	57.4	61.0	18.2	6
20	0.6162	0.5711	1.34	19x32	0	0.203	0.927	1.03	1.00	1.03	1.05	35.1	37.4	26.4	6
18	0.9627	0.8969	1.34	19x30	0	0.254	1.18	1.19	1.19	1.28	1.31	21.1	22.3	41.0	6
16	1.229	1.146	1.19	19x29	0	0.287	1.31	1.35	1.35	1.46	1.48	16.1	16.9	52.2	6

1/ Nominal values are for information only. Nominal values are not requirements.

THIS SOFT METRIC CONVERSION TABLE III-C PROVIDES A CROSS-REFERENCE TO TABLE II-C.
FOR INFORMATION ONLY

TABLE III-D. Details of 27 percent nickel coated (NHC/NHA) conductor (soft metric conversion).

Size desig-nation	Cross-sectional area (mm^2)		K-value	Stranding (no. of strands X AWG of strands)	Allowable no. of missing strands (max)	Nominal dia. of individual strands (mm) 1/	Diameter of stranded conductor		Max resistance of conductor (ohms/km at 20 °C		Elongation (%, Min)	
	Nominal (All) 1/	Minimum					Min (mm)	Max (mm)	(NHC)	(NHA)	(NHC)	(NHA)
22	0.3821	0.3517	1.87	19x34	0	0.160	0.737	0.838	77.8	84.0	10	6
20	0.6162	0.5711	1.34	19x32	0	0.203	0.927	1.05	47.9	50.1	10	6
18	0.9627	0.8969	1.34	19x30	0	0.254	1.16	1.32	30.0	31.5	10	6
16	1.229	1.146	1.19	19x29	0	0.287	1.32	1.55	22.5	24.0	10	6
14	1.941	1.809	1.38	19x27	0	0.361	1.65	1.88	14.2		10	
12	3.085	2.874	1.67	19x25	0	0.455	2.08	2.39	9.12		10	
10	5.006	4.416	1.35	49x27	0	0.361	3.12	3.28	5.51		10	
8	8.605	8.434	2.29	133x29	0	0.287	4.01	4.55	3.07		10	
6	13.59	13.32	2.31	133x27	0	0.361	5.03	5.54	1.94		10	
4	21.59	21.16	2.55	133x25	0	0.455	6.35	6.91	1.23		10	
2	33.70	32.92	3.21	665x30	2	0.254	8.13	8.76	0.791		10	
1	41.40	40.47	2.89	817x30	2	0.254	9.02	9.75	0.643		10	
01	52.95	51.75	3.24	1,045x30	3	0.254	10.0	11.0	0.502		10	
02	67.39	65.90	3.15	1,330x30	3	0.254	11.2	12.4	0.394		10	
03	84.37	82.49	3.09	1,665x30	4	0.254	12.7	13.9	0.315		10	
04	106.86	104.49	3.32	2,109x30	5	0.254	14.4	15.6	0.253		10	

1/ Nominal values are for information only. Nominal values are not requirements.

THIS SOFT METRIC CONVERSION TABLE III-D PROVIDES A CROSS-REFERENCE TO TABLE II-D.
FOR INFORMATION ONLY

TABLE III-E. Details of ultra-high strength copper alloy conductors (soft metric conversion). 1/

Size designation	Conductor area (mm^2)		K-value	Stranding (no. of strands X AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia. of individual strands (mm) 2/	Diameter of stranded conductor		Maximum resistance (ohms/km) at 20 °C 3/	Min break strength (kgs)	Elongation (% min)
	Nominal 2/	Minimum					Min (mm)	Max (mm)			
26	0.1540	0.1393	1.34	19x38	0	0.102	0.445	0.518	185 192	9.56	6

1/ Applies to silver and nickel coated conductors, unless otherwise noted.
2/ Nominal values are for information only. Nominal values are not requirements.
3/ 185 is for silver coated conductors only and 192 is for nickel coated conductors only.

THIS SOFT METRIC CONVERSION TABLE III-E PROVIDES A CROSS-REFERENCE TO TABLE II-E.
FOR INFORMATION ONLY

TABLE III-F. Details of type KPH, KPS, KNH and KNS extension conductors (soft metric conversion).

Size designation	Conductor area (mm^2)		Stranding (no. of strands x AWG of strands)	Allowable no. of missing strands (Max)	Nominal dia of individual Strands (MM) 1/	1/ General purpose Conductor diameter		Resistance (ohms/km @ 20°C)			
	Nominal	Minimum				Min (mm)	Max (mm)	KP (H or S)		KN (H or S)	
								Min.	Max.	Min.	Max.
22	.3821	.3517	19x34	0	.160	.737	.838	1793.6	1982.6	748.7	827.8
20	.6162	.5711	19x32	0	.203	.940	1.04	1112.9	1230.3	464.2	513.5
18	.9627	.8969	19x30	0	.254	1.17	1.30	711.9	787.4	296.9	328.7
16	1.229	1.146	19x29	0	.287	1.32	1.47	556.8	615.8	231.6	256.6
14	1.941	1.809	19x27	0	.361	1.65	1.85	353.0	390.4	147.3	163.1

1/ No small diameter thermocouple conductors exist at this time.

THIS SOFT METRIC CONVERSION TABLE III-F PROVIDES A CROSS-REFERENCE TO TABLE II-F.
FOR INFORMATION ONLY

Custodians:
Army - CR
Navy - AS
AF - 85

Preparing activity:
Navy - AS

(Project 6145-2009-031)

Review activities:
Army - AR
Navy - SH

NOTE: The activities above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.daps.dla.mil.