



AEROSPACE STANDARD

AS81044™**REV. B**Issued 1998-07
Revised 2019-07

Superseding AS81044A

(R) Wire, Electrical, Crosslinked Polyalkene, Crosslinked Alkane-Imide Polymer,
or Polyarylene Insulated, Copper or Copper Alloy

RATIONALE

Total revision required to reorganize the specification in accordance with AE-8 specification guidelines, add AS29606 conductors, AS9003 Quality Control, statistical process control, UV marking, and make minor technical changes as needed.

1. SCOPE

1.1 Scope

AS81044 covers single conductor electric wires made as specified in the applicable detail specification with tin-coated, silver-coated, or nickel-coated copper or copper alloy conductors insulated with crosslinked polyalkene, crosslinked alkane-imide polymer, or polyarylene. The crosslinked polyalkene, crosslinked alkane-imide polymer, or polyarylene may be used alone or in combination with other insulation materials as specified in the detail specification.

1.2 Classification

The wires shall be as described in the applicable detail specification.

1.2.1 Part Numbers

Part numbers under this specification are coded as in the following example:

<u>M81044/1</u>	-	<u>22</u>	-	<u>9</u>
Applicable detail specification	-	WIRE SIZE	-	Insulation color designator or designators

1.2.2 Voltage Rating

The voltage rating of a wire for continuous use is specified in the detail specification (see 6.1.4).

1.2.3 Temperature Rating of Finished Wire

The maximum conductor temperature of the finished wire for continuous use shall be as specified in the applicable detail specification (6.1.1).

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Documents
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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 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.

AMS1424	Fluid, Aircraft Deicing/Anti-Icing, SAE Type I
AIR5717	Mitigating Wire Insulation Damage During Processing and Handling
ARP5607	Legibility of Print on Aerospace Wires and Cables
ARP6400	Recommended Practice for Processing and Handling Wire and Cable with Silver Plated Conductors and Shields
AS4461	Assembly and Soldering Criteria for High Quality/High Reliability Soldered Wire and Cable Termination in Aerospace Vehicles
AS4373	Test Methods for Insulated Electric Wire
AS5768	Tool, Stripper, Electrical Insulation, General Specification For
AS5768/1	Tool, Stripper, Manually Actuated, Electrical Insulation, Round Wire, Size 10 to 30
AS9003	Inspection and Test Quality Systems Requirements for Aviation, Space, and Defense Organizations
AS9138	Aerospace Series - Quality Management Systems Statistical Product Acceptance Requirements
AS29606	Wire, Electrical, Stranded, Uninsulated Copper, Copper Alloy, or Aluminum, or Thermocouple Extension, General Specification For
AS50881	Wiring, Aerospace Vehicle
AS81044/5*	Wire, Electric, Crosslinked Polyalkene Insulated, Silver-Coated Copper, Normal Weight, 600-Volt, 150 °C
AS81044/6*	Wire, Electric, Crosslinked Polyalkene Insulated, Tin-Coated Copper, Normal Weight, 600-Volt, 150 °C
AS81044/7*	Wire, Electric, Crosslinked Polyalkene Insulated, Silver-Coated High Strength Copper Alloy, Normal Weight, 600-Volt, 150 °C
AS81044/8*	Wire, Electric, Crosslinked Polyalkene Insulated, Silver-Coated Copper, Medium Weight, 600-Volt, 150 °C
AS81044/9*	Wire, Electric, Crosslinked Polyalkene Insulated, Tin-Coated Copper, Medium Weight, 600-Volt, 150 °C
AS81044/10*	Wire, Electric, Crosslinked Polyalkene Insulated, Silver-Coated High Strength Copper Alloy, Medium Weight, 600-Volt, 150 °C
AS81044/11*	Wire, Electric, Crosslinked Polyalkene Insulated, Silver-Coated Copper, Light Weight, 600-Volt, 150 °C

- AS81044/12* Wire, Electric, Crosslinked Polyalkene Insulated, Tin-Coated Copper Light Weight, 600-Volt, 150 °C
- AS81044/13* Wire, Electric, Crosslinked Polyalkene Insulated, Silver-Coated High Strength Copper Alloy, Light Weight, 600-Volt, 150 °C

*AS81044 Detail Specification

2.1.2 U.S. Government Publications

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

- MIL-DTL-5624 Turbine Fuel, Aviation, Grades JP-4 and JP-5
- MIL-DTL-12000 Cable, Cord, and Wire, Electric; Packaging of
- MIL-DTL-83133 Turbine Fuel, Aviation, Kerosene Types, NATO F-34 (JP-8) and NATO F-35
- MIL-PRF-5606 Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
- MIL-PRF-23699 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
- MIL-STD-104 Limits for Electrical Insulation Color
- MIL-STD-202 Test Methods, Electronic and Electrical Component Parts
- MIL-STD-681 Identification Coding and Application of Hookup and Lead Wire
- MIL-W-81044/1 Wire, Electric, Crosslinked Polyalkene Insulated, Silver Coated Copper, Abrasion Resistant, 600 Volt, 135 Deg. C (S/S By MIL-W-81044/6)
- MIL-W-81044/2 Wire, Electric, Crosslinked Polyalkene Insulated, Tin Coated Copper, Abrasion Resistant, 600 Volt, 135 Deg. C (S/S By MIL-W-81044/6)
- MIL-W-81044/3 Wire, Electric, Crosslinked Polyalkene Insulated, Silver Coated Copper, Light Weight, 600 Volt, 135 Deg. C (S/S By MIL-W-81044/12)
- MIL-W-81044/4 Wire, Electric, Crosslinked Polyalkene Insulated, Tin Coated Copper, Light Weight, 600 Volt, 135 Deg. C (S/S By MIL-W-81044/12)
- MIL-W-81044/14 Wire, Electric, Crosslinked Polyalkene Insulated, Tin Coated Copper, Medium Weight, 600 Volt, 135 Deg. C. (S/S By Mil-W-81044/9)
- MIL-W-81044/15 Wire, Electric, Crosslinked Polyalkene Insulated, Silver Coated High Strength Copper Alloy, Medium Weight, 600 Volt, 135 Deg. C (S/S By Mil-W-81044/10)
- MIL-W-81044/16 Wire, Electric, Crosslinked Alkane-Imide Polymer Insulated, Tin Coated Copper, Normal Weight, 600 Volt, 150 Deg. C
- MIL-W-81044/17 Wire, Electric, Crosslinked Alkane-Imide Polymer Insulated, Silver Coated High Strength Copper Alloy, Normal Weight, 600 Volt, 150 Deg. C
- MIL-W-81044/18 Wire, Electric, Crosslinked Alkane Imide Polymer Insulated, Tin Coated Copper, Light Weight, 600 Volt, 150 Deg. C
- MIL-W-81044/19 Wire, Electric, Crosslinked Alkane-Imide Polymer Insulated, Silver Coated High Strength Copper Alloy, Light Weight, 600 Volt, 150 Deg. C
- MIL-W-81044/20 Wire, Electric, Polyarylene Insulated, Tin Coated Copper, Normal Weight, 600 Volt, 150 Deg. C

MIL-W-81044/21	Wire, Electric, Polyarylene Insulated, Silver Coated Copper, Normal Weight, 600 Volt, 200 Deg. C
MIL-W-81044/22	Wire, Electric, Polyarylene Insulated, Silver Coated High Strength Copper Alloy, Normal Weight, 600 Volt, 200 Deg. C
MIL-W-81044/23	Wire, Electric, Polyarylene Insulated, Nickel Coated Copper, Normal Weight, 600 Volt, 260 Deg. C
MIL-W-81044/24	Wire, Electric, Polyarylene Insulated, Nickel Coated High Strength Copper Alloy, Normal Weight, 600 Volt, 260 Deg. C
MIL-W-81044/25	Wire, Electric, Polyarylene Insulated, Tin Coated Copper, Lightweight, 600 Volt, 150 Deg. C
MIL-W-81044/26	Wire, Electric, Polyarylene Insulated, Silver-Coated Copper, Lightweight, 600-Volt, 200 Degrees C
MIL-W-81044/27	Wire, Electric, Polyarylene Insulated, Silver Coated High Strength Copper Alloy, Lightweight, 600 Volt, 200 Deg. C
MIL-W-81044/28	Wire, Electric, Polyarylene-Insulated, Nickel-Coated Copper, Lightweight, 600-Volt, 260 Degrees C
MIL-W-81044/29	Wire, Electric, Polyarylene-Insulated, Nickel-Coated High-Strength Copper Alloy, Lightweight, 600-Volt, 260 Degrees C
SD-6	Provisions Governing Qualification
SAM	System for Award Management*

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

2.1.3 ASQ Publications

Available from American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203, Tel: 800-248-1946 (United States or Canada), 001-800-514-1564 (Mexico) or +1-414-272-8575 (all other locations), www.asq.org.

ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes

ASQ 9000 Quality Management Systems - Fundamentals and Vocabulary

2.1.4 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 D770 Standard Specification for Isopropyl Alcohol

2.1.5 National Conference of Standards Laboratories (NCSL)

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

2.2 Definitions

2.2.1 CRITICAL DEFECTS

A critical defect is a defect that judgment and experience indicate would result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the product, or a defect that judgment and experience indicate is likely to prevent performance of the actual function of a major end item such as a ship, aircraft, tank, missile, or space vehicle.

2.2.2 DEFECT

A defect is any nonconformance of the unit of product with specified requirements.

2.2.3 MAJOR DEFECT

A major defect is a defect, other than critical, that is likely to result in failure, or to reduce the usability of the unit of product for its intended purpose.

2.2.4 MINOR DEFECT

A minor defect is a defect that is not likely to reduce materially the usability of the unit of product for its intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the unit.

2.2.5 CONDUCTOR PITTING

Conductor pitting is small holes or cavities in the conductor surface that are large enough to be seen with the unaided eye. Discoloration (such as the formation of inter-metallic compounds) or surface changes caused by the flow of tin are not considered pitting.

2.2.6 FINISHED WIRE

A finished wire is a conductor covered by primary insulation layer(s) and/or a jacket. Also known as Wire.

2.2.7 CONDUCTOR

A wire conductor is a conductive material which carries the electrical load from one end of the wire to the other end of the wire.

2.2.8 WIRE PRIMARY INSULATION

A wire primary insulation is the center core insulation layer (extrusion or tape) next to the conductor that provides most or all of the electrical protection and some or all mechanical protection.

2.2.9 WIRE JACKET INSULATION

A Wire Jacket Insulation is an outer layer of electrical non-conductive or semi-conductive insulation (extruded or tape) that provides mostly mechanical protection for the wire.

3. REQUIREMENTS

3.1 Detail specifications

The requirements for the individual wires shall be as specified herein and in accordance with the applicable detail specification. In the event of any conflict between the requirements of AS81044 and the detail specification, the requirements of the detail specification shall govern.

3.1.1 Detail Specification Exception

The blocking temperature of AS81044/5 shall be 150 °C in lieu of 225 °C.

3.2 Classification of Requirements

The applicable requirements are classified herein as follows:

- a. Qualification (see 3.3)
- b. Materials (see 3.4)
- c. Finished Wire Construction (see 3.5)
- d. Finished Wire Requirements (see 3.6)

3.3 Qualification

The wire furnished herein shall be a product that has been tested and has passed the qualification tests specified herein and has been listed on or approved for listing on the applicable Qualified Products List (see 6.5).

3.3.1 Conformity to Qualified Sample

Except for changes approved by the purchase order, it is understood that wire supplied under the purchase order shall be the same material formulations, material sources, and manufacturing processes as approved by the Qualifying Activity. Any unapproved changes made after the qualification approval date, unless accepted by the Qualifying Activity, may constitute cause for rejection. All identified unapproved changes must be reported to the Qualifying Activity. Failure of a manufacturer to notify the Qualifying Activity of a change in design, material, manufacturing process (including quality conformance) or plant location shall be reason for adverse action or removal from the Qualified Products List.

3.4 Materials

Unless otherwise specified in the detail specification, the wire materials shall be as specified herein.

3.4.1 Conductor Material

All conductors shall be qualified and shall meet the material requirements of AS29606. The wire supplier is responsible for all quality assurance and compliance requirements imposed on the conductor per AS29606 (see 4.7.2). Conductor material data shall be maintained for a minimum of 6 years (see 4.7.2).

3.4.2 Insulating Material

All primary insulation shall be crosslinked polyalkene, crosslinked alkane-imide polymer, or polyarylene, as specified in the applicable detail specification. Insulation coatings or jackets, if present, shall also be of the material specified in the detail specification. All insulating materials, including primary insulation and coating or jacket, shall be certified virgin material (3.4.2.1) containing no additives except those required as pigmentation for colors, lubricants used in extrusion and stabilizers.

3.4.2.1 Virgin Material

For purposes of this specification, virgin material shall be 100% new material which has been through only the processes essential to its manufacture and its application to the wire and has been through these essential processes one time only. Any material which has previously been processed in any other manner is considered nonvirgin material. This requirement shall apply to the manufacture of all ingredients and components used.

3.5 Finished Wire Construction

Finished wire construction shall be verified in accordance with 4.7.1.

3.5.1 Conductor Construction Prior to Insulation Application

The conductor construction prior to the application of the insulation shall be qualified conductor in accordance with AS29606.

3.5.2 Finished Wire Diameter

The finished wire diameter shall be as specified in the detail specification

3.5.2.1 Finished Wire Conductor and Stranding

The finished wire conductor diameter and stranding shall be as specified in the detail specification and in accordance with AS29606.

3.5.3 Finished Wire Insulation Construction

The insulation shall be constructed as specified in the applicable detail specification.

3.5.3.1 Finished Wire Removability of the Insulation

The insulation for wire sizes 12 and larger shall be removable by conventional wire stripping devices without damage to the conductor. Insulation for wire sizes 10 and smaller shall be removable in accordance with AS5768 using an AS5768/1 stripping tool and the wire shall be found "acceptable" as defined by AS5768.

3.5.4 Finished Wire Conductor Splice

The insulated conductor splices shall meet the requirement of AS29606.

3.5.5 Finished Wire Conductor Elongation and Tensile Strength

The insulated conductor elongation and tensile break strength shall be in accordance with AS29606 when tested in accordance with 4.7.5.6.

3.5.6 Finished Wire Conductor Resistance

The insulated conductor resistance shall be as specified in the detail specification when tested in accordance with 4.7.5.5.

3.5.7 Primary Insulation Flaws (see 4.7.4 and 4.7.5.1)

100% of the insulated conductor shall be inspected for dielectric flaws after application of the primary insulation and prior to the application of any other material to the wire. At the option of the supplier, the inspection shall be made by either the spark test, the impulse dielectric test or the high frequency spark test of 4.7.5.1. The test voltages for primary insulation shall be as specified in the detail specification except the high frequency voltage shall be 4.2 kV (rms).

3.6 Finished Wire Requirements (see Table 1 for information)

The finished wire shall conform to the requirements of 3.5, 3.6, and the detail specification.

3.6.1 Finished Wire Insulation Flaws

100% of the finished wire shall pass the insulation flaws test of 4.7.5.1, using either the spark test, the impulse dielectric test, or the high frequency spark test. The voltage for the high frequency spark test on finished wire shall be 5.7 kV (rms). All flaws shall be removed (see 4.4.1.5). The test shall be made during the final winding of the wire on shipment spools or reels.

Table 1 - Properties of finished wire

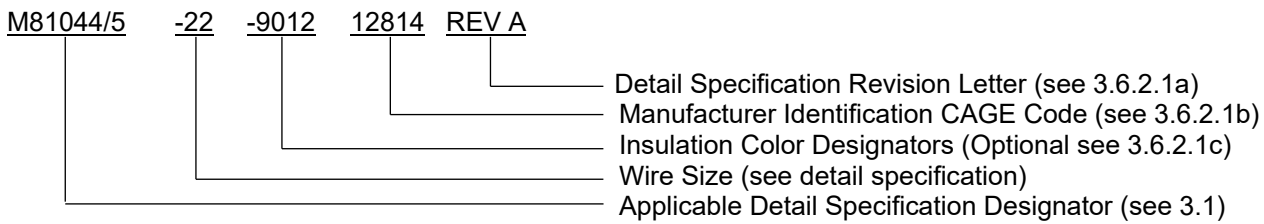
Examination or Test	Requirement	Method
Conductor stranding	3.5.2.1	4.7.1
Conductor diameter	3.5.2.1	4.7.1
Finished Wire Diameter	3.5.2	4.7.1
insulation Construction	3.5.3	4.7.1
Removability of the insulation	3.5.3.1	4.7.1
Conductor splice	3.5.4	4.7.1
Insulation Flaws	3.6.1	4.7.5.1
Insulation resistance	3.6.3	4.7.5.2
Color	3.6.2	4.7.1
Color striping or banding durability	3.6.2	4.7.5.3
Identification of product	3.6.2	4.7.1
Durability of identification	3.6.2	4.7.5.3
Weight	3.6.9	4.7.5.4
Conductor resistance	3.5.6	4.7.5.5
Conductor elongation and tensile strength	3.5.5	4.7.5.6
Insulation elongation and tensile strength	3.6.10	4.7.5.7
Wrap (as applicable)	3.6.4	4.7.5.8
Wrap back	3.6.4.1	4.7.5.8.1
Mandrel wrap	3.6.4.2	4.7.5.8.2
Insulation thickness	3.6.5	4.7.5.9
Concentricity	3.6.6	4.7.5.10
Blocking	3.6.7	4.7.5.11
Workmanship	3.6.8	4.7.1
Polyimide cure	3.6.11	4.7.5.12
Shrinkage	3.6.12	4.7.5.13
Wicking	3.6.13	4.7.5.14
Low temperature (cold bend)	3.6.14	4.7.5.16
Thermal shock resistance	3.6.15	4.7.5.17
Flammability	3.6.16	4.7.5.18
Life cycle	3.6.17	4.7.5.19
Accelerated aging	3.6.18	4.7.5.20
Fluid immersion	3.6.19	4.7.5.21
Humidity resistance	3.6.20	4.7.5.22
Surface resistance	3.6.21	4.7.5.23
Smoke resistance	3.6.22	4.7.5.24
Solderability (when applicable)	3.6.23	4.7.5.26
Continuous lengths	3.6.24	4.7.5.25

3.6.2 Finished Wire Identification (see 4.7.1 and 6.1.7)

Wire identification shall be examined in accordance with 4.7.1.

3.6.2.1 Wire Identification Printed Marking and Location

Unless otherwise specified in the detail specification, the wire shall be identified by a printed marking applied to the outer surface of the wire or be visible through the outer surface, for wire sizes 26 and larger. Wire sizes 28 and smaller do not require identification print marking. For ink marking, the printed identification shall be at intervals of 6 to 60 inches, as measured from the end of one complete marking to the beginning of the succeeding complete marking. For UV Laser marking, the interval shall be at 7, 11, or 13 inches. The identification mark shall not be applied by hot stamp marking or other methods that significantly penetrate the insulation. The printed marking on the wire shall be as follows:



- a. The wire shall be marked with the latest revision letter specified for the detail specification (see 6.8). If the detail specification has no revision letter, the revision letter is not required.
- b. The wire shall be marked with the manufacturer's identification in accordance with the manufacturer's Commercial and Government Entity (CAGE) listed in "SAM".
- c. The insulation color designator (wire color, stripes, bands, or tracers) is not required in the printed marking, but is required in all reference documentation. At the option of the wire supplier, the color code portion of the part number (see 1.2.1) may be included but, if included, it shall be included in its entirety, not in part.

3.6.2.1.1.1 Identification Printed Ink Marking Characteristics and Color

Unless otherwise specified in the detail specification, the ink printing shall be green in color in accordance with MIL-STD-104, Class 1, except that when the wire is any color against which green is difficult to distinguish, the ink printing shall be white. Identification printing shall be applied with the vertical axes of the printed characters lengthwise of the wire when the nominal diameter of the wire is 0.050 inch or smaller. The vertical axes of the printed characters may be either crosswise or lengthwise of the wire when the nominal diameter of the wire exceeds 0.050 inch. All printed characters shall be complete and legible. Ink printing shall comply with the requirements of 3.6.2.

3.6.2.1.2 Identification Printed UV Laser Marking Characteristics

As an alternate method to ink marking identified in 3.6.2.1, UV laser marking may also be used to apply the wire identification mark as noted in 3.6.2.1.1. The Identification printing shall be applied with the vertical axes of the characters lengthwise on the wire when the nominal diameter of the wire is 0.050 inch or smaller. The vertical axes of the printed characters may be either crosswise or lengthwise on the wire when the nominal diameter of the wire exceeds 0.050 inch. All printed characters shall be complete and legible. Wire processors may want to refer to ARP5607 when establishing the appropriate character font and size to improve legibility.

3.6.2.2 Wire Color Designators and Munsell Limits

The colors of the wire shall be as indicated by the insulation color designator (see 1.2.1 and 3.6.2.2.1) of the wire part number. The first digit of the designator shall indicate the background insulation color and the succeeding digits, if any, shall indicate the colors of the stripes, bands, or tracers as indicated in 1.2.1 and 3.6.2.2.2.

3.6.2.2.1 Background Insulation Color Designator

The background insulation color designator of the wire shall be listed in MIL-STD-681, System I (differentiation color coding for chassis wiring). Unless otherwise specified in the detail specification or the designated part number (see 1.2.1), the preferred background insulation color designator shall be white (-9). Any applicable restrictions on available colors shall be indicated in the detail specification. Unless otherwise specified in the detail specification, the Munsell color limit of the background insulation shall be in accordance with MIL-STD-104, Class 1. When detail specification requires minimum UV Laser marking contrast levels, the Munsell limits shall be as specified in Table 2.