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AEROSPACE STANDARD

SAE AS4372 REV. B

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(R)

Performance Requirements for Wire, Electric, Insulated Copper or Copper Alloy

FOREWORD

This SAE Aerospace Standard (AS) contains performance-oriented requirements intended to evaluate electric wire for aerospace applications. The results of testing wires to the requirements of this standard should aid designers in selecting suitable wires for their particular applications.

The requirements of this standard are classified as follows:

a. Design Evaluation: Specific requirements are given.
b. Information Only: No specific requirements, but test results shall be reported.

These classifications are based on the existence of specific general performance levels for these requirements and not on the importance of the particular requirement. Requirements for process control and quality conformance are not included in this document since this is not a purchase specification.

This document provides baseline criteria and some minimum performance levels for aerospace wire. These requirements may need to be supplemented or revised by the designer to meet the particular application.

Sound engineering judgment must be the overriding criteria for test selection, interpretation of test results, and resulting aerospace wire application. Results from all tests may not be required for every wire application selection problem. A number of the performance requirements documented in this standard are long term procedures and/or are costly in terms of time and/or equipment.

NOTE: The requirements of this document were collected from a number of aerospace vehicle manufacturers. Therefore, some common requirements have established minimum performance levels while other requirements are more user-specific and are classified as information only.

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1. SCOPE:

1.1 This document covers the requirements for insulated, single-conductor, electric wires with tin-coated, silver-coated, or nickel-coated conductors of copper or copper alloy as specified in an applicable generated performance sheet (see Appendix A for sample). It provides general performance requirements, ratings, and information for various characteristics of insulated wire systems used in aerospace applications. Numerical test requirements, or parameters, were originally developed using either English or metric units. The original, primary, units are shown first with the secondary (converted) units in parentheses. Secondary units are listed for information only and are not to be considered requirements.

Wire will be assigned a level of performance for many requirements set forth in this standard. These performance levels, in addition to numerical test results, shall be listed in the applicable performance sheet. This standard contains some tests and referenced AS4373 Test Methods that have not been rigorously confirmed as reproducible. Such methods are identified under the Precision and Bias Statements in the individual AS4373 Test Methods. Many requirements have multiple levels of performance. The wire with base level of performance is acceptable for general use; however, there may be special applications that will require wire with higher performance levels.

1.2 Construction:

The wires shall be constructed as described in the applicable performance sheet.

1.2.1 Performance Sheet Identification: Each performance sheet will have an identifying number as shown in Figure 1.

ABCDEFG	-	01234
Manufacturer or User Code		Manufacturer I.D.

FIGURE 1

The manufacturer/user code can be the part number used by either one. The manufacturer identification should be the Commercial and Government Entity (CAGE) Code per publication H4-1 and H4-2.

2. 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 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AS4373	Test Methods for Insulated Electric Wire
AS50881	Wiring, Aerospace Vehicle

2.2 ASTM Publications: Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

ASTM B 33	Wire, Copper, Tinned Soft or Annealed, for Electrical Purposes
ASTM B 298	Wire, Copper, Silver Coated Soft or Annealed
ASTM B 355	Wire, Copper, Nickel Coated Soft or Annealed
ASTM B 624	Copper, High Strength, High Conductivity
ASTM E 29	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

2.3 U.S. Government Publications: Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

H4-1	Commercial and Government Entity (CAGE) for Manufacturers Part 1, Name to Code
H4-2	Commercial and Government Entity (CAGE) for Manufacturers Part 2, Code to Name

3. REQUIREMENTS:

3.1 General:

3.1.1 Performance Sheets: The requirements for the individual wires under this standard shall be as listed herein and as described in the applicable performance sheet. The format of the performance sheet shall be in accordance with the sample provided in Appendix A.

3.1.2 Design Evaluation: Some paragraphs in this document are specifically included to provide the design engineer with information needed in evaluating a new wire construction. These design evaluation requirements and paragraphs are listed below:

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3.1.3 "Information Only": Some paragraphs in this document require that test values be measured and recorded but do not establish a minimum performance level. This data is for information only and is intended to provide the designer with data without imposing minimum acceptable results. The “Information Only” paragraphs are listed below:

3.2.1 Solderability
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3.2.3 Solder Pot Test for Insulation Shrinkage
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3.8.7	Flame Resistance

3.1.4 Workmanship: All details of workmanship shall be in accordance with high quality aerospace manufacturing practices. The insulation shall be free of foreign materials and irregularities such as cracks, splits, and bubbles. Color shall be uniform (free of mottling and streaking).

3.1.5 Finished Wire: The finished wire shall conform to the requirements of this document and those of the applicable performance sheet.

3.1.6 Insulation Construction: Insulation shall be constructed as specified in the applicable performance sheet.

3.2 Assembly, Handling, and Repair:

3.2.1 Solderability (Tin Coated Copper Wire Only): When tested in accordance with Method 105 of AS4373, tin coated copper wire specimens shall have 95% of the termination covered by continuous new solder. Pinholes and voids shall not be concentrated and shall be less than 5% of the total termination area. Three specimens of each wire size shall be tested to one of the conditions listed in Table 1 and the results averaged.

TABLE 1

Condition	Hours of Steam Aging	Flux
A	8	Type R
B	1	Type R
C	0	Type R

3.2.2 Thermal/Mechanical Resistance: When tested in accordance with Method 106 of AS4373 for single wire and Method 107 for wire in a bundle, size 22 specimens shall exhibit their ability to resist damage from a soldering iron heated to 550 °F (288 °C), 650 °F (343 °C), and 750 °F (399 °C). The average time to penetrate at each temperature shall be recorded on the performance sheet. If penetration does not occur within the maximum time limit, "no penetration" shall be recorded on the performance sheet.

3.2.3 Solder Pot Test for Insulation Shrinkage: When tested in accordance with Method 108 of AS4373, three size 22 wire specimens shall have the insulation shrinkage measured. The average shrinkage shall be recorded in the performance sheet.

3.2.4 Insulation Bonding to Potting Compounds: When tested in accordance with Method 102 of AS4373, five size 22 AWG wire specimens shall have the pull-out strength measured. The average pull-out strength shall be recorded on the performance sheet.

3.3 Chemical, Biological, Radiological/Nuclear, Biological Chemical [CBR(NBC)]:

When required by a user, specimens of insulation material shall be tested to CBR/NBC. Note that the Air Force has established an extensive data base on the chemical compatibility of materials for use in aerospace vehicles. While this data base as a whole is classified information, it has been made available to prime aerospace contractors. Current contact for this data base is at WL/MSLA, Wright Patterson AFB, Ohio. In addition, the Army has done extensive testing of a number of materials and should be consulted before testing to determine if a candidate insulation material has already been tested. Contact for this is NBC Survivability Office, Army CR&D, Edgewood, MD.

The intent of this material testing is to assure inertness of a material to the CBR/NBC exposure. Because of this, Test Methods Group 200 of AS4373 gives no procedure. The Air Force and the Army have established over a dozen qualified laboratories to do this type of CBR/NBC testing. These laboratories are not empowered to determine the suitability of an item such as a wire after exposure, only to determine if there is an effect on the materials used for insulation. It is not recommended that handling of items after exposure be done outside of these qualified labs due to personnel safety considerations.

3.4 Conductor:

3.4.1 Conductor Diameter: When tested in accordance with Method 401 of AS4373, conductor diameter shall meet the dimensions of Table 2. The average conductor diameter for applicable sizes shall be listed in the performance sheet.

3.4.2 Conductor Elongation and Tensile Breaking Strength:

3.4.2.1 Soft or Annealed Copper: When tested in accordance with Method 402 of AS4373, the individual strands removed from finished wires with soft or annealed copper conductors, wire sizes 20 and larger, or the whole soft or annealed copper conductor removed from finished wire, sizes 22 and smaller, shall have the following minimum elongation:

a. Size 24 and smaller: 6% (min)
b. Size 22 and larger: 10% (min) for SPC and TPC
8% (min) for NPC

The tensile breaking strength for size 20 and smaller shall be measured and recorded on the performance sheet.

3.4.2.2 High Strength Copper Alloy: When tested in accordance with Method 402 of AS4373, the whole conductor removed from the finished wire shall exhibit a minimum 6% elongation. The tensile breaking strength shall conform with Table 2 or shall be described in the performance sheet.

3.4.3 Conductor Material: All strands used in the manufacture of the conductors shall be tin-coated, silver-coated, or nickel-coated soft or annealed copper conforming to ASTM B 33, B 298, or B 355, as applicable, or shall be silver-coated or nickel-coated high strength copper alloy conforming to ASTM B 624 for the alloy and B 298 or B 355, as applicable, for the coating. Strands shall be free from lumps, kinks, splits, scrapes, surface impurities, or surface imperfections. In addition, the strands shall conform to the following requirements as applicable.

3.4.3.1 Tin-Coated Copper Strands: The tin coating shall be as specified in ASTM B 33.

3.4.3.2 Silver-Coated Copper Strands: The strands shall have a coating thickness of not less than 40 µin of silver when tested in accordance with ASTM B 298.

3.4.3.3 Nickel-Coated Copper Strands: The strands shall have a coating thickness of not less than 50 µin of nickel when tested in accordance with ASTM B 355.

3.4.3.4 High Strength Copper Alloy Strands: The strands shall be of the applicable AWG specified in Table 2 and of such tensile properties that the conductor from the finished wire conforms to the requirements of 3.5.2.2 for elongation and tensile breaking strength. The strands shall be silver-coated or nickel-coated in accordance with 3.5.3.2 or 3.5.3.3, as applicable.

3.4.4 Conductor Resistance: When tested in accordance with Method 403 of AS4373, the conductor resistance of finished wire shall meet the requirements of Table 2 and shall be recorded in the performance sheet. Deviations to the maximum resistance values of Table 2 are allowed for high strength alloys with higher breaking strength (see Table 2, Note 2). The higher breaking strength and their resistance values shall be listed in the performance sheet.

3.4.5 Conductor Splices: Splices in individual strands of the conductor or rope member shall be butt-brazed. In no case shall the whole conductor be spliced at any one point. Members composing rope-lay-stranded conductors may be joined as a unit and shall be at least two lay lengths apart. In all cases, the splice shall be finished such that the diameter is not increased at the joint.

3.4.6 Conductor Strand Blocking: When tested in accordance with Method 404 of AS4373, wire strands of conductor sizes 14 through 26 shall exhibit a count of 13 minimum, and conductor sizes 28 and 30 shall exhibit a count of 5 minimum.

3.4.7 Conductor Stranding: Conductors shall conform to the stranding requirements of Table 2 and the following subsections. If other specific stranding configurations are required, it should be stated in the procurement document. The stranding for applicable conductor sizes shall be listed in the performance sheet.

TABLE 2 - Details of Conductors

Size Desig-nation (AWG)	Conductor Area (Cir-mils)[3] Nominal[1] (All)	Conductor Area (Cir-mils)[3] Min	K-Value	Stranding No. of Strands X AWG of Strands	Allowable No. of Missing Strands (Max)	Nominal Dia of Individual Strands (inch)[1]	Dia Min (inch)	Dia General Pupose Silver Coated	Dia General Purpose Nickel or Tin Coated	Max (inch) Small Dia (CU) Silver Coated	Max (inch) Small Dia (CU) Nickel or Tin Coated	Small Dia (Alloy) Silver Plated	Small Dia (Alloy) Nickel Coated	Maximum Resistance of Finished Wire (ohms/1000 ft @ 20 °C) Soft or Annealed Copper Silver Coated	Maximum Resistance of Finished Wire (ohms/1000 ft @ 20 °C) Soft or Annealed Copper Nickel Coated	Maximum Resistance of Finished Wire (ohms/1000 ft @ 20 °C) Soft or Annealed Copper Tin Coated	Maximum Resistance of Finished Wire (ohms/1000 ft @ 20 °C) High Str CU Alloy Silver Coated	Maximum Resistance of Finished Wire (ohms/1000 ft @ 20 °C) High Str CU Alloy Nickel Coated	Breaking Strength Alloy Conductor (lb) (Min)[2]
30	112	102	.77	7 x 38	0	0.0040	0.011	0.012	0.013	0.012	0.013	0.012	0.013	100.7	110.7	108.4	117.4	129.6	5.17
28	175	161	1.05	7 x 36	0	0.0050	0.014	0.015	0.016	0.015	0.016	0.015	0.016	63.8	67.9	68.6	74.4	79.0	8.16
26	304	275	1.34	19 x 38	0	0.0040	0.018	0.020	0.021	0.019	0.020	0.020	0.020	38.4	42.2	41.3	44.8	49.4	14.2
24	475	434	1.18	19 x 36	0	0.0050	0.023	0.025	0.026	0.024	0.024	0.024	0.025	24.3	25.9	26.2	28.4	30.1	22.4
22	754	694	1.87	19 x 34	0	0.0063	0.029	0.032	0.033	0.030	0.031	0.031	0.031	15.1	16.0	16.2	17.5	18.6	35.8
20	1,216	1,127	1.34	19 x 32	0	0.0080	0.037	0.040	0.041	0.038	0.039	0.039	0.040	9.19	9.77	9.88	10.7	11.4	58.1
18	1,900	1,770	1.34	19 x 30	0	0.0100	0.046	0.050	0.051	0.048	0.049	-	-	5.79	6.10	6.23			
16	2,426	2,261	1.19	19 x 29	0	0.0113	0.052	0.057	0.058	0.054	0.055	-	-	4.52	4.76	4.81			
14	3,831	3,570	1.38	19 x 27	0	0.0142	0.065	0.072	0.073	0.068	0.069	-	-	2.88	3.00	3.06			
12	5,874	5,473	1.26	37 x 28	0	0.0126	0.084	0.089	0.090	0.087	0.089	-	-	1.90	1.98	2.02			
10	9,354	8,716	1.35	37 x 26	0	0.0159	0.106	0.112	0.114	0.110	0.112	-	-	1.19	1.24	1.26			
8	16,983	16,645	2.29	133 x 29	0	0.0113	0.158	0.169	0.173	0.166	0.169	-	-	0.658	0.694	0.701			
6	26,818	26,284	2.31	133 x 27	0	0.0142	0.198	0.213	0.217	0.208	0.212	-	-	0.418	0.436	0.445			
4	42,615	41,767	2.55	133 x 25	0	0.0179	0.250	0.268	0.274	0.263	0.268	-	-	0.264	0.275	0.280			
2	66,500	64,981	3.21	665 x 30	2	0.0100	0.320	0.340	0.340	-	-	-	-	0.170	0.177	0.183			
1	81,700	79,878	2.89	817 x 30	2	0.0100	0.360	0.380	0.380	-	-	-	-	0.139	0.144	0.149			
0	104,500	102,126	3.24	1045 x 30	3	0.0100	0.395	0.425	0.425	-	-	-	-	0.108	0.113	0.116			
00	133,000	130,059	3.15	1330 x 30	3	0.0100	0.440	0.475	0.475	-	-	-	-	0.085	0.089	0.091			
000	166,500	162,795	3.09	1665 x 30	4	0.0100	0.500	0.540	0.540	-	-	-	-	0.068	0.071	0.071			
0000	210,900	206,213	3.32	2109 x 30	5	0.0100	0.565	0.605	0.605	-	-	-	-	0.054	0.056	0.056			

[1] Nominal values are for information only. Nominal values are not requirements.
[2] New alloys have been developed with higher break strength and also higher resistance values than those shown in Table 2. If used, the properties of these high strength alloys shall be defined in 3.5 of the performance sheet.
[3] For measurement of conductor area, see MIL-W-29606.

3.4.7.1 Concentric Lay Stranding: The conductors of wire sizes 30 through 10 shall be concentric lay conductors stranded as specified in Table 2. Concentric lay shall be interpreted to be a central strand surrounded by one or more layers of helically wound strands. It is optional for the direction of lay of the successive layers to be alternately reversed (true concentric lay) or to be in the same direction (unidirectional lay). The strands shall be assembled in a geometric arrangement of concentric layers, so as to produce a smooth and uniform conductor, circular in cross-section and free of any crossovers, high strands, or other irregularities. The direction of lay of the individual strands in the outer layer of the concentrically stranded conductors of finished wire shall be left hand.

The length of lay of the outer layer shall not be less than 8 nor more than 16 times the maximum conductor diameter as specified in the applicable performance sheet.

3.4.7.2 Rope Lay Stranding: The conductors of wire sizes 8 through 0000 shall be rope lay conductors stranded as specified in Table 2 and in a and b below.

a. Rope lay stranded conductors shall be laid up concentrically with a central member surrounded by one or more layers of helically wound members. It is optional for the direction of lay of successive layers to be alternately reversed (true concentric lay), or to be in the same direction (unidirectional lay). The length of lay of the outer layer of rope lay stranded members forming the conductor shall not be less than 8 or more than 14 times the outside diameter of the completed conductor. The direction of lay of the outside layer shall be either left or right hand.

b. Members of rope lay stranded conductors: The length of lay of the wires composing the stranded members shall not be greater than 16 times the outside diameter of the member. Stranding of the individual members may be either concentric or bunch.

3.5 Electrical:

3.5.1 Dielectric Constant: When tested in accordance with Method 501 of AS4373, the dielectric constant of size 22 wire shall be calculated and recorded in the performance sheet.

3.5.2 Corona Inception and Extinction Voltages: In most applications, the corona inception and extinction voltages are far above actual use in aerospace vehicles. Corona extinction voltage (CEV) can be calculated using the method described in AS50881 once the dielectric constant and the insulation thickness are known. If calculated levels of corona are of a concern, the wire can be tested per Method 502 of AS4373. The calculated or measured test values shall be recorded on the performance sheets.

3.5.3 Surface Resistance: When tested in accordance with Method 506 of AS4373, the surface resistance of finished wire shall be recorded on the performance sheet. This test was primarily designed for wire constructions with outer braids as part of the insulation system but may be used to test other constructions.

3.5.4 Time/Current to Smoke: When tested in accordance with Method 507 of AS4373, the time and current at observation of first smoke shall be measured and recorded on the performance sheet for wire size 22.

3.5.5 Voltage Rating: The requirement and test method for voltage rating are to be determined. (See Test Method 512 of AS4373.)

3.5.6 Dry Arc Propagation Resistance: When tested in accordance with Method 508 of AS4373, the number of wires that pass the dielectric test and the length of physical damage to the individual wires in the bundle shall be recorded on the performance sheet.

3.5.7 Wet Arc Propagation Resistance: When tested in accordance with Method 509 of AS4373, the number of wires that pass the dielectric test and the length of physical damage to the individual wires in the bundle shall be recorded on the performance sheet.

3.5.8 Wire Fusing Time: When tested in accordance with Method 511 of AS4373, the time to melt the conductor and interrupt current (fuse) for a size 22 wire carrying a 250% single wire free air current shall be determined. Three specimens shall be tested and the average recorded in the performance sheet. If fusing does not occur within 5 min, record "5 min +".

3.6 Environmental:

3.6.1 Fluid Immersion: When tested in accordance with Method 601 of AS4373, finished wire shall have a maximum diameter increase of 5%, shall not crack during the bend test, and shall have no dielectric breakdown. Three specimens of size 22 wire shall be tested in each fluid and failure of any specimen to meet any of the three requirements shall constitute failure.

3.6.2 Forced Hydrolysis:

3.6.2.1 Unconditioned Wire: When tested in accordance with Method 602 of AS4373, any dielectric failure for three size 22 wire specimens shall be recorded.

3.6.2.2 Heat Conditioned Wire: When preconditioned and then tested in accordance with Method 602 of AS4373, any dielectric failure for three size 22 wire specimens shall be recorded.

3.6.3 Humidity Resistance: When tested in accordance with Method 603 of AS4373, the average humidity resistance of three specimens of size 22 wire shall be recorded on the performance sheet.

3.6.4 Weight Loss Under Temperature and Vacuum: When tested in accordance with Method 604 of AS4373, the weight of the finished wire shall be reported before and after preconditioning and after temperature and vacuum treatment. Three specimens of size 22 wire shall be preconditioned at 95% (±5%) relative humidity (RH) for 168 h at 38 °C ± 3 °C (100 °F ± 5 °F) and three size 22 specimens shall be preconditioned at 5% (±5%) relative humidity for 168 h at 38 °C ± 3 °C (100 °F ± 5 °F). The average weight of the three specimens from each condition shall be listed in the performance sheet.

3.6.5 Propellant Resistance: With ever-increasing local and federal regulations for handling corrosive, toxic and/or explosive materials such as propellants, it is impractical for non-government laboratories to perform this type of test. The manufacturers of missile systems who use these propellants have their own propellant tests, and they report that they also routinely route wires and cables away from areas in their missiles where even accidental spillage may have had come in contact with installed wires and cables. As a result, a test method for propellant resistance is not included in AS4373.

3.6.6 Weathering Resistance: When tested in accordance with Method 606 of AS4373, cracking or splitting of the insulation shall be noted on the performance sheet and the color and any marking on the insulation shall be examined and any visible changes reported. Six size 22 wire specimens shall be tested and the results reported after bend and dielectric tests.

3.6.7 Wicking: When tested in accordance with Method 607 of AS4373, the wicking within or between layers of insulation shall conform to the requirements below and shall be recorded on the performance sheet. Three specimens of size 22 wire shall be tested.

a. Braided wire maximum dye travel: 0.75 in
b. Dual layer maximum dye travel between layers: 2.25 in

If the size 22 exceeds these limits, a size larger than 10 shall also be tested and the results recorded on the performance sheet.

3.7 Mechanical:

3.7.1 Abrasion: A requirement for the abrasion resistance of wire has not been included in this standard. It has been shown that no single test method can reproduce the various conditions of abrasion that can occur in an aerospace vehicle. The various tests that have been tried over many years have shown poor reproducibility. Therefore, there is not a test method for abrasion in AS4373.

3.7.2 Cold Bend: When tested on the 10X mandrel in accordance with Method 702 of AS4373, the finished wire specimens shall exhibit no cracking of insulation and no dielectric breakdown. Three specimens each of sizes 22 and 10 wire shall be tested and the results recorded on the performance sheet. Also record the mandrel diameter and weight used.

3.7.3 Dynamic Cut-Through: When tested in accordance with Method 703 of AS4373, the force required for insulation cut-through shall be determined at room temperature, 70 °C (158 °F), 150 °C (302 °F), and 200 °C (392 °F). Three specimens of size 22 wire shall be tested at each temperature. The cut-through force at each temperature shall be recorded on the performance sheet.

3.7.4 Flex Life: When tested in accordance with Method 704 of AS4373, specimens of size 22 wire shall be tested for flex life and the results recorded on the performance sheet.

3.7.5 Insulation Impact Resistance: While most users agree this is an important criteria for consideration in high performance aircraft, there does not appear to be a test that will give repeatable or meaningful results for this parameter. It is suggested that results from other mechanical tests (such as dynamic cut through), be substituted for this property of insulation. As a result, there is no test method for Insulation Impact Resistance in AS4373.

3.7.6 Notch Propagation: When tested in accordance with Method 706 of AS4373, the notch propagation at two notch depths (25% and 50% of measured wall thickness) shall be determined. Six size 22 specimens shall be cycled to failure at each of the 2 notch depths (12 specimens total) and the average number of cycles to failure shall be reported on the performance sheet. Any decimal places that result from averaging shall be truncated to get a whole number of cycles.

3.7.7 Stiffness and Springback: When tested in accordance with Method 707 of AS4373, the stiffness and springback for size 22 wire specimens shall be determined for a 4 in (102 mm) span selector setting. Three unconditioned specimens shall be tested and the average values for stiffness and for springback shall be recorded on the performance sheet.

3.7.8 Vibration: There is no standard requirement for wire and cable to address an acceptable performance level for this property. Individual tests have been performed on wire harnesses based upon the vibration parameters of individual vehicles (installation practices, loads, frequencies, etc.). Since each vehicle will have different vibration characteristics, a single test will not provide the assurance that wire or cables will function without being damaged. This property is more a system requirement than a wire or cable requirement. As a result there is no test in AS4373 to cover vibration.

3.7.9 Durability and Legibility of Wire Installer's Identification: When tested in accordance with Test Method 711 of AS4373, the installer's applied identification must remain legible after the abrasion durability test. The results of the wet dielectric test shall be reported. This test shall be run whenever new materials are used or equipment has been reset.

3.8 Thermal:

3.8.1 Flammability: When tested in accordance with Method 801 of AS4373, finished wire shall conform to the requirements below. Three size 22 wire specimens shall be tested and the results reported in the performance sheet.

a. After Flame: 30 s (maximum)
b. Flame Travel: 3 in (7.6 cm) (maximum)

3.8.2 High Pressure/High Temperature Air Impingement (Burst Duct): When tested in accordance with Method 802 of AS4373, the results of this test shall be noted and recorded on the performance sheet. This requirement is only relevant to wire routed near aircraft bleed air ducts that may burst. Wire size, number of samples to be tested and adjustments in test pressure and temperature should be considered for each application.

3.8.3 Smoke Quantity: When tested in accordance with Method 803 of AS4373, the specific optical density produced by finished wire shall be measured at 90 s, 4 min, 10 min, and 20 min. These values in addition to the time at which maximum smoke density occurs shall be recorded on the performance sheet. One 22 AWG wire specimen shall be tested.

3.8.4 Temperature Index: When tested in accordance with Method 804 of AS4373, the temperature index at 10,000 h shall be determined for wire specimens and listed on the performance sheet. Wire size and number of samples to be tested shall be as described in Method 804. This temperature index shall be the rated insulation temperature of the wire at 10,000 h.

3.8.5 Toxicity: Despite extensive industry testing there is no single test recognized as being meaningful and/or repeatable to cover toxicity levels of wire and cables. Work continues by fire safety organizations and independent laboratories to develop these requirements. When industry concurrence is reached for test methodology and requirements, appropriate requirements will be added to future revisions. As a result there is no test method in AS4373.

3.8.6 Property Retention After Thermal Aging: When tested in accordance with Method 806 of AS4373, the performance of size 22 wire specimens that have been thermally aged for 1000 h at rated temperature shall be measured for dynamic cut-through, flex life, and notch propagation and the results recorded in the performance sheet. The recorded data on aged wire shall be compared with the data on unaged wire.

3.8.7 Flame Resistance: When tested in accordance with Method 812 of AS4373, the insulation shall not flake or fall off the conductor. At no time shall the measured resistance be less than 1000 Ω and the flame travel shall not extend beyond the outer marking bands. This requirement is applicable to fire zone wire only.

3.9 Wire Diameter and Weight:

3.9.1 Finished Wire Diameter: When tested in accordance with Method 901 of AS4373, finished wire diameter shall be classified in one of the categories listed in Table 3 and shall be recorded on the performance sheet.

3.9.1.1 Wire/Connector Compatibility: The diameter of finished wire shall be in accordance with the present connector sealing ranges for contact sizes 22D, 22, 20, 16, 12, 8, 4, and 0.

3.9.2 Finished Wire Weight: When tested in accordance with Method 902 of AS4373, finished wire weight and which procedure used shall be recorded on the performance sheet.

TABLE 3 - Classification by Wire Diameter[1]

Size	Thin Wall Max Dia. (in)	Medium Wall Max Dia. (in)	Thick Wall Min Dia. (in)
30	0.026[2]	0.031	0.032
28	0.030	0.036	0.037
26	0.034	0.042	0.043
24	0.039	0.051	0.052
22	0.045	0.054	0.055
20	0.054	0.064	0.065
18	0.064	0.074	0.075
16	0.072	0.082	0.083
14	0.083	0.099	0.100
12	0.102	0.117	0.118
10	0.125	0.143	0.144
8		0.208	0.209
6		0.258	0.259
4		0.320	0.321
2		0.421	0.422
1		0.461	0.462
0		0.501	0.502
00		0.563	0.564
000			0.610
0000			0.680

[1] Follow ASTM E 29 for significant digits
[2] At present, there is no contract for wire size 30 in thin wall.

4. NOTES:

4.1 Intended Use:

The intended use of this document is to provide the designer with performance data to assist in the selection or application of insulated wire (see FOREWORD).

4.2 Temperature Rating:

The temperature rating for insulation shall be equivalent to the temperature index at 10,000 h per 3.9.4. The temperature rating of the conductors shall be as described below.

a. Tin coated: 150 °C
b. Silver coated: 200 °C
c. Nickel coated: 260 °C

The maximum temperature rating of the finished wire shall be the lower temperature rating of either the insulation or conductor, and this lower temperature shall be used for testing purposes. Other factors in addition to temperature index must also be considered for aerospace vehicle wire application, such as cut-through, fluids, bend radius, etc.

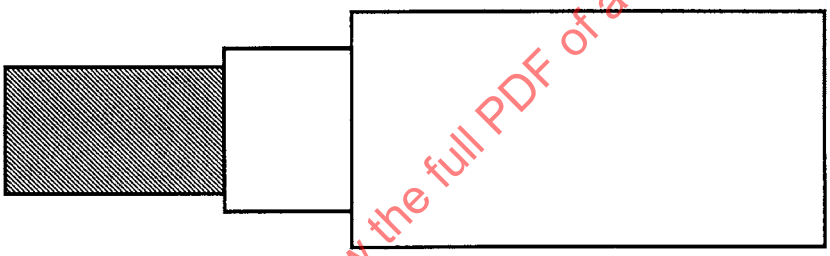
4.3 The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document.

PREPARED UNDER THE JURISDICTION OF
SAE SUBCOMMITTEE AE-8D, WIRE AND CABLE OF
COMMITTEE AE-8, AEROSPACE ELECTRICAL/ELECTRONIC DISTRIBUTION SYSTEMS

APPENDIX A
SAMPLE PERFORMANCE SHEET
WIRE, ELECTRIC, INSULATED

_____
Manufacturer or User Code

_____
Manufacturer I.D.



Describe conductor (Type of stranding (3.5.7) copper or copper alloy, type of coating)

Describe insulation tapes, extrusions, braids, etc. as applicable

PERFORMANCE TEST RESULTS

ASSEMBLY, HANDLING AND REPAIR (3.2)

Solderability (tin-coated copper conductors only) (3.2.1) (TM 105)[1]

	Percent Coverage	
Condition Type	Actual Results	Average Result
_____	_____	_____
_____	_____	_____
_____	_____	_____

[1] TM = Test Method

FIGURE A1

Thermal Mechanical Resistance (3.2.2) (TM 106, 107)

SOLDER IRON TEMPERATURE	TIME TO PENETRATE (SECONDS) TM 106 (Single Wire)	TM 107 (Bundle)
750 °F	_____	_____
650 °F	_____	_____
550 °F	_____	_____

Solder Pot Test for Insulation Shrinkage (3.2.3) (TM 108)

Average Shrinkage _____

Insulation Bonding to Potting Compounds (3.2.4) (TM 102)

Average Pull-out Strength _____ MPa
Type of Potting Compound _____
Manufacturer _____
Surface Preparation _____

FIGURE A1 (Continued)