The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

AEROSPACE STANDARD

SAE AS4372

Issued 1990-08-13

Submitted for recognition as an American National Standard

PERFORMANCE REQUIREMENTS FOR WIRE, ELECTRIC, INSULATED COPPER OR COPPER ALLOY

FOREWORD

This 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:

Design Evaluation - Specific requirements are given.

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 judgement must be the overiding 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 the applicable 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.

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. These test methods contain some new tests that have not been rigorously confirmed as reproducible. Such new methods are identified under the Precision and Bias Statements in the individual 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.

2.2.1 Performance Sheet Identification: Each sheet will have an identifying number as in the following example:

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

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. REFERENCES:

2.1 Government-Furnished Documents:

The following documents of the issue listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) form a part of this specification to the extent specified herein.

2.1.1 Specifications:

Military:

MIL-W-5088 Wiring, Aerospace Vehicle

2.1.2 Publications:

Defense Logistics Services Center:

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

(Copies of specifications, standards, drawings, and publication required by supplier in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other Publications:

The following documents form a part of this standard to the extent specified herein. The issues of the documents that are Department of Defense (DOD) adopted shall be those listed in the issue of the DODISS specified in the solicitation. The issue of the documents which have not been adopted shall be those in effect on the date of the cited DODISS.

2.2.1 Society of Automotive Engineers:

AS4373	Test Methods for Insulated Electric Wire

2.2.2 American Society of Testing and Materials:

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

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 performance sheet of 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:

3.5.1 Conductor diameter
3.5.2 Conductor elongation and tensile breaking strength
3.5.3 Conductor material
3.5.4 Conductor resistance
3.5.7 Conductor stranding
3.6.5 Voltage rating
3.7.1 Fluid immersion
3.7.7 Wicking
3.8.1 Abrasion
3.8.2 Cold bend
3.8.3 Dynamic cut through
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3.8.6 Notch propagation
3.8.7 Stiffness and springback
3.8.8 Vibration
3.9.1 Flammability
3.9.4 Thermal index
3.10.1 Finished wire diameter
3.10.2 Finished wire weight

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
3.2.2 Thermal/mechanical resistance
3.2.3 Solder pot test for insulation shrinkage
3.3 Chemical, biological, radiological/nuclear, biological, chemical (CBR/NBC)
3.4.1 Dry arc resistance and fault propagation
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3.6.1 Dielectric constant
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3.9.3 Smoke quantity
3.9.5 Toxicity
3.9.6 Property retention after thermal aging
3.9.7 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 106 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 below and the results averaged.

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

3.2.2 Thermal/Mechanical Resistance: When tested in accordance with Method 107 of AS4373 for single wire and Method 108 for wire in a bundle, size 22 specimens shall exhibit their ability to resist damage from a soldering iron heated to 550°F (290°C), 650°F (345°C), and 750°F (400°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 109 of AS4373, three size 22 wire specimens shall have the insulation shrinkage measured. The average shrinkage shall be recorded in 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 the CBR/NBC requirements as stated in Army Regulation 70-71. Note that the Air Force has established an extensive data base on the chemical compatibilty 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 WRDC-MLSA, Wright Patterson AFB, Ohio, phone (513) 255-5117. 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, phone (301) 671-3410.

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 Combat Damage:

3.4.1 Dry Arc Resistance and Fault Propagation: When tested in accordance with Method 301 of AS4373, the arc time or flame duration, the number of circuit breakers and the number of common integrity circuits passing the Voltage Withstand (Wet Dielectric) test shall be recorded on the performance sheet. Three harnesses shall be tested and the results for each shall be recorded. (This is one of several test methods being considered by ASTM at present. This test method may be revised when ASTM has completed the development of this test.)

3.5 Conductor:

3.5.1 Conductor Diameter: When tested in accordance with Method 401 of AS4373, conductor diameter shall meet the dimensions of Table 1. The average conductor diameter for applicable sizes shall be listed in the performance sheet.

3.5.2 Conductor Elongation and Tensile Breaking Strength:

3.5.2.1 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:

Size 24 and smaller - 6% (min)
Size 22 and larger - 10% (min)

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

TABLE 1 - Details of Conductors

SIZE DESIG-NATION	NOMINAL CONDUCTOR AREA (Cir. Mils)[1]	STRANDING (NO. OF STRANDS X AWG OF STRANDS	ALLOWABLE NO. OF MISSING STRANDS (MAX)	NOMINAL DIA OF INDIVIDUAL STRANDS (inch)[1]	DIAMETER OF STANDARD CONDUCTOR MIN. (inch)	DIAMETER OF STANDARD CONDUCTOR MAX (inch)						MAXIMUM RESISTANCE OF FINISHED WIRE (ohms/1000 ft at 20°C)					BREAKING STRENGTH, ALLOY CONDUCTOR (LBS) (MIN)[2]
						GENERAL PURPOSE		SMALL DIA (CU)		SMALL DIA (ALLOY)		SOFT OR ANNEALED COPPER			HIGH STR CU ALLOY		
						SILVER COATED	NICKEL OR TIN COATED	SILVER COATED	NICKEL OR TIN COATED	SILVER PLATED	NICKEL COATED	SILVER COATED	NICKEL COATED	TIN COATED	SILVER COATED	NICKEL COATED	
30	112	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	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	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	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	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	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	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	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	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	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	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	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	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	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	665 x 30	2	0.0100	0.320	0.340	0.340	–	–	–	–	0.170	0.177	0.183			
1	81 700	817 x 30	2	0.0100	0.360	0.380	0.380	–	–	–	–	0.139	0.144	0.149			
0	104 500	1045 x 30	3	0.0100	0.395	0.425	0.425	–	–	–	–	0.108	0.113	0.116			
00	133 000	1330 x 30	3	0.0100	0.440	0.475	0.475	–	–	–	–	0.085	0.089	0.091			
000	166 500	1665 x 30	4	0.0100	0.500	0.540	0.540	–	–	–	–	0.068	0.071	0.071			
0000	210 900	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 1. If used, the properties of these high strength alloys shall be defined in 4.5 of the performance sheet.

3.5.2.2 High Strength Copper Alloy: When tested in accordance with Method 403 of AS4373, the whole conductor removed from finished wires with high strength copper alloy conductors shall exhibit elongation of 6%, minimum. The tensile breaking strength shall conform with Table 1 or shall be as described in the performance sheet.

3.5.3 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.

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

3.5.3.2 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.

3.5.3.3 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.

3.5.3.4 High Strength Copper Alloy Strands: The strands shall be of the applicable AWG specified in Table 1 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.

3.5.4 Conductor Resistance: When tested in accordance with Method 404 of AS4373, conductor resistance of finished wire shall meet the requirements of Table 1 and shall be recorded in the performance sheet. Deviations to the maximum resistance values of Table 1 are allowed for high strength alloys with higher breaking strength (see Table 1, Note 2). The higher breaking strength and their resistance values shall be listed in the performance sheet.

3.5.5 Conductor Splices: Splices in individual strands of the conductor or rope member shall be butt brazed. In no case shall the conductor as whole 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.

3.5.6 Conductor Strand Blocking: When tested in accordance with Method 405 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.

3.5.7 Conductor Stranding: Conductors shall conform to the stranding requirements of Table 1 and the subsections below. 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.

3.5.7.1 Concentric Lay Stranding: The conductors of wire sizes 30 through 10 shall be concentric lay conductors stranded as specified in Table 1. 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.

3.5.7.2 Rope Lay Stranding: The conductors of wire sizes 8 through 0000 shall be rope lay conductors stranded as specified in Table 1 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.

3.6 Electrical:

3.6.1 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.

3.6.2 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 MIL-W-5088 once dielectric constant and 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.

3.6.3 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.

3.6.4 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.

3.6.5 Voltage Rating: The requirement and test for voltage rating are to be determined. (See Test Method 508 of AS4373.)

3.6.6 Wet Arc-Tracking: When tested in accordance with Method 509 of AS4373, the results of the wet arc tracking test shall be noted and recorded on the performance sheet. Five bundles of size 20 wires shall be tested. Method 509 is the BSI Standard as of March, 1989. An ASTM test method is also being developed and the test method may be revised when this work is complete.

3.6.7 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 +".

3.7 Environmental:

3.7.1 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.

3.7.2 Forced Hydrolysis:

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

3.7.2.2 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.

3.7.3 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.

3.7.4 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 (100°F ± 5) and three size 22 specimens shall be preconditioned at 5% (±5) relative humidity for 168 h at 38°C ± 3 (100°F ± 5). The average weight of the three specimens from each condition shall be listed in the performance sheet.

3.7.5 Propellant Resistance: When tested in accordance with Method 605 of AS4373, wire specimens shall be examined and tested for cracked insulation and/or dielectric breakdown after separate, nonsequential exposure to the three propellants listed in the test method. Three specimens of size 22 wire shall be immersed in each propellant. The results shall be listed in the performance sheet.

3.7.6 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.

3.7.7 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.

3.8 Mechanical:

3.8.1 Abrasion: The requirement and test for abrasion are to be determined. (See Test Method 701 of AS4373.)

3.8.2 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.

3.8.3 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, 150°C, and 200°C. 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.

3.8.4 Flex Life: The requirement and test for flex life are to be determined. (See Test Method 704 of AS4373.)

3.8.5 Insulation Impact Resistance: The requirement and test for insulation impact resistance are to be determined. (See Test Method 705 of AS4373.)

3.8.6 Notch Propagation: When tested in accordance with Method 707 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.

3.8.7 Stiffness and Springback: When tested in accordance with Method 708 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.

3.8.8 Vibration: The requirement and test for vibration are to be determined. (See Test Method 709 of AS4373.)

3.8.9 Wire Surface Markability: The requirement and test for wire surface markability are to be determined. (See Test Method 713 of AS4373.)

3.9 Thermal:

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

Afterflame: 30 s (maximum)
Flame Travel: 3 in (7.6 cm) (maximum)
Tissue Flaming: None

3.9.2 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 which may burst. Wire size, number of samples to be tested and adjustments in test pressure and temperature should be considered for each application.

3.9.3 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 size 22 wire specimen shall be tested.

3.9.4 Thermal Index: When tested in accordance with Method 804 of AS4373, the thermal 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 thermal index shall be the rated insulation temperature of the wire at 10 000 h.

3.9.5 Toxicity: The requirement and test for toxicity are to be determined. (See Test Method 806 of AS4373.)

3.9.6 Property Retention After Thermal Aging: When tested in accordance with Method 807 of AS4373, the performance of size 22 wire specimens that have been thermally aged for 1000 h at rated temperature shall be measured for abrasion resistance, dynamic cut-through, flex life, and notch propagation and recorded in the performance sheet.

3.9.7 Flame Resistance: When tested in accordance with Method 813 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.

3.10 Wire Diameter and Weight:

3.10.1 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 2 below and shall be recorded on the performance sheet.

TABLE 2 - Classification by Wire Diameter (Wall Thickness)

SIZE	THIN WALL (In) MAX (DIA)	MEDIUM WALL (In) MAX (DIA)	THICK WALL WIRE (In) MIN (DIA)
30	.026[1]	.031	.032
28	.030	.036	.037
26	.034	.042	.043
24	.039	.051	.052
22	.045	.054	.055
20	.054	.064	.065
18	.064	.074	.075
16	.072	.082	.083
14	.083	.099	.100
12	.102	.117	.118
10	.125	.143	.144
8		.208	.209
6		.258	.259
4		.320	.321
2		.421	.422
1		.461	.462
0		.501	.502
00		.563	.564
000			.610
0000			.680

[1]At present there is no contact for wire size 30 in thin wall.

3.10.1.1 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.

3.10.2 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.

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 the FOREWORD).

4.2 Temperature Rating:

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

Tin plated	150°C
Silver plated	200°C
Nickel plated	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 thermal index must also be considered for aerospace vehicle wire application temperature ratings such as cut-through, fluids, bend radius, etc.

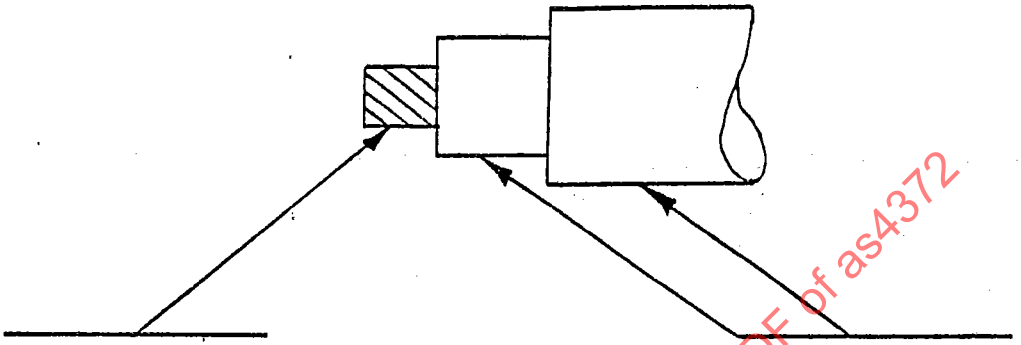
PREPARED BY SAE SUBCOMMITTEE AE-8D, WIRE AND CABLE OF COMMITTEE AE-8, AEROSPACE ELECTRICAL/ELECTRONIC DISTRIBUTION SYSTEMS

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 106)[A]

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

- Thermal Mechanical Resistance (3.2.2) (TM 107, 108)

SOLDER IRON TEMPERATURE	TIME TO PENETRATE (SEC) TM 107 (Single Wire)	TM 108 (Bundle)
750°F	_____	_____
650°F	_____	_____
550°F	_____	_____

- Solder Pot Test for Insulation Shrinkage (3.2.3) (TM 109)

  Average Shrinkage _____

[A]TM = Test Method