MIL-W-5845C
5 October 1973
SUPERSEDING
MIL-W-5845B
25 March 1958

MILITARY SPECIFICATION

WIRE, ELECTRICAL, IRON AND CONSTANTAN, THERMOCOUPLE

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

1. SCOPE

1.1 Scope. This specification covers iron and constantan thermocouple wire.

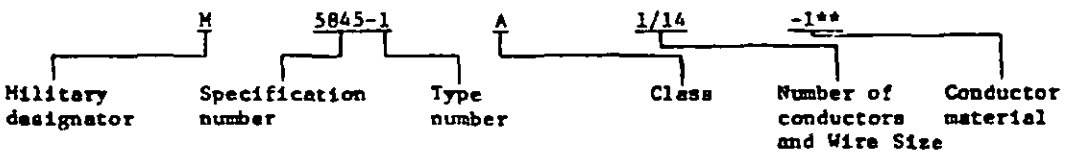
1.2 Classification. Thermocouple wire shall be of the following types and classes as specified (see 6.1):

Type 1 Solid and stranded conductor
- Class A - Bare (solid conductor) high accuracy
- Class B - Insulated (solid conductor) high accuracy
- Class C - Insulated duplex (solid conductor) high accuracy
- Class D - Insulated (stranded conductor) high accuracy
- Class E - Insulated duplex (stranded conductor) high accuracy
- Class F - Bare (solid conductor) nominal accuracy
- Class G - Insulated (solid conductor) nominal accuracy
- Class H - Insulated duplex (solid conductor) nominal accuracy
- Class I - Insulated (stranded conductor) nominal accuracy
- Class J - Insulated duplex (stranded conductor) nominal accuracy

Type 2 Stranded conductor (8 ohms per 100-foot length)
- Class A - Insulated duplex with each strand of iron wire tinned 120°C rating
- Class B - Insulated duplex with each strand of iron wire tinned 230°C rating
- Class C - Insulated duplex with iron wire not tinned

Type 3 Stranded conductor (8 ohms per 200-foot length)
- Class A - Insulated duplex with each strand of iron wire tinned 120°C rating
- Class B - Insulated duplex with each strand of iron wire tinned 230°C rating
- Class C - Insulated duplex with iron wire not tinned

1.2.1 Military part number. The military part number shall consist of the letter "M", the basic number of the specification, and an assigned dash number as shown below. Information to be inserted shall be derived from 1.2 and Table I.



**For single conductor wire the wire material shall follow the wire size preceded by a dash.
I = Iron C = Constantan

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS

Federal

O-A-548	---Antifreeze, Ethylene Glycol, Inhibited
TT-I-735	---Isopropyl Alcohol
TT-S-735	---Standard Test Fluids: Hydrocarbon

Military

MIL-T-5438	---Tester: Abrasion, Electrical Cable
MIL-L-6082	---Lubricating Oil; Aircraft Reciprocating Engine (Piston)
MIL-C-12000	---Cable, Cord, and Wire, Electric Packaging Of

STANDARDS

Military

MIL-STD-129	---Marking For Shipment and Storage
MIL-STD-130	---Identification Marking of U.S. Military Property
MIL-STD-143	---Specifications and Standards Order of Precedence For The Selection Of
MIL-STD-687	---Wire, Thermocouple, Identification Marking and Color Code Of
MIL-STD-810	---Environmental Test Methods
MIL-STD-831	---Test Reports, preparation of

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

3. REQUIREMENTS

3.1 Preproduction. Unless otherwise specified, preproduction inspection is required and preproduction samples shall meet the requirements specified herein (see 6.2.1).

3.2 MATERIAL

3.2.1 Selection of specifications and standards. Specifications and standards for necessary commodities and services not specified shall be selected in accordance with MIL-STD-143.

3.3 Construction. The wire shall be constructed as follows:

Type 1 Classes A and F - Bare solid iron or constantan conductor

Type 1 Classes B, D, G, and I
First - Solid or stranded iron or constantan conductor
Second - Inner wrap (if required)
Third - Primary insulation
Fourth - Layer of braid, fibrous covering or other approved material (if required)
Fifth - Outer protective coating (if required)

Type 1 Classes C, E, H, and J
First - Solid or stranded iron and constantan conductor
Second - Inner wrap (if required) (individual conductors)
Third - Primary insulation (individual conductors)
Fourth - Layer of braid, fibrous covering or other approved material (if required) (individual conductors)
Fifth - Iron and constantan insulated wires laid in parallel and covered with duplexing outer covering
Sixth - Outer protective coating (if required)

Types 2 and 3	Classes A, B, and C First - Stranded iron and constantan conductors Second - Inner wrap (if required) (individual conductors) Third - Primary insulation (individual conductors) Fourth - Layer of braid, fibrous covering or other approved material (if required) (individual conductors) Fifth - Iron and constantan insulated wires laid in parellel and covered with duplexing outer covering Sixth - Outer protective coating (if required)

3.3.1 Conductors

3.3.1.1 Metals. The conductors shall consist of iron or constantan as specified herein. The conductors shall be free from lumps, kinks, splits, abrasions, and scraped or corroded surfaces.

3.3.1.2 Stranding. Stranding may be bunched, concentric, or rope lay and as specified in table I. The wire size of all strands shall be the same for any one conductor except for Types 2 and 3, classes A, B, and C wire where the strand size may vary to facilitate resistance adjustment.

3.3.1.3 Electromotive force. The temperature-electromotive force relationship of the iron and constantan conductors formed together as a thermocouple shall conform to table II within the tolerances listed in table III. (See 4.6.3)

3.3.1.4 Splices. Splices in individual strands of a stranded conductor shall be of the butt type. Splices in strands which are composed of a group of individual strands shall be of the butt type. Butt type splices shall be 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.

3.3.1.5 Size. The area of the conductors for Type 1 shall be as specified in Table I. The area of the conductor shall not exceed 5 percent under or 5 percent over the nominal value specified.

3.3.1.6 Annealing temperature. The type 1 wire shall be annealed by the manufacturer at a temperature of 816°C or higher

3.3.1.7 Tinning. Each strand of iron wire for types 2 and 3, classes A and B, wire shall be thoroughly and uniformly coated with commercially pure tin. Continuity of the coating shall be determined by the conductor tinning test specified herein (See 4.6.2).

3.3.2 Insulation. The wire insulation shall consist of a concentric layer or layers of suitable materials, capable of meeting the requirements specified herein. The insulation shall be readily removed with the conventional wire stripping machine and should have a uniform surface and diameter (See 4.6.1).

3.3.2.1 Inner wrap. The inner wrap, if used, shall consist of a suitable material which shall be braided, woven, or wrapped tightly about the stranded conductor and be capable of meeting the requirements specified herein. The material shall not cause corrosion of the conductor when subjected to the temperature requirements specified herein (See 4.6.7, 4.6.10).

3.3.2.2 Primary insulation. Each conductor shall have a primary insulation consisting of a concentric layer of felted asbestos, asbestos braid or wrap, glass fibers, or a multiple layer wrap of a suitable synthetic resinous tape or other material capable of meeting the requirements specified herein. Where a fibrous primary insulation is used, the material shall be impregnated with a silicone resin or other suitable compound and so applied that it will not enter the conductor strands and affect good electrical contact. The impregnating compound shall bond the insulation sufficiently to prevent fraying under normal conditions of installation.

TABLE I. Details of Wire Construction

Type	Class	American Wire Gage	Nominal Conductor Diameter (inches)	Nominal Conductor Area (circular mils)	Maximum Diameter of Finished Wire (inches)	Number of Strands (min)	Weight lb (max)
1	A&F	14	0.0641	4106			
		16	0.0508	2583			
		18	0.0403	1624			
		20	0.0320	1021			
		22	0.0254	642			
		24	0.0201	404			
		26	0.0159	254			
		28	0.0126	160			
		30	0.0100	101			
1	B&G	14	0.0641	4106	0.150		
		16	0.0508	2583	0.130		
		18	0.0403	1624	0.115		
		20	0.0320	1021	0.110		
		22	0.0254	642	0.085		
		24	0.0201	404	0.073		
		26	0.0159	254	0.050		
		28	0.0126	160	0.040		
		30	0.0100	101	0.030		
1	C&H (See Note 1)	14	0.0641	4106	0.275		
		16	0.0508	2583	0.250		
		18	0.0403	1624	0.225		
		20	0.0320	1021	0.185		
		22	0.0254	642	0.170		
		24	0.0201	404	0.160		
		26	0.0159	254	0.150		
		28	0.0126	160	0.140		
		30	0.0100	101	1.130		
1	D&I	14	0.080	4106	0.170	10	
		16	0.063	2583	0.150	10	
		18	0.048	1624	0.135	7	
		20	0.039	1021	0.115	4	
		22	0.030	642	0.095	3	
		24	0.025	404	0.080	3	
		26	0.020	254	0.070	3	
1	E&J (See Note 1)	14	0.080	4106	0.315	10	
		16	0.063	2583	0.280	10	
		18	0.048	1624	0.245	7	
		20	0.039	1021	0.200	4	
		22	0.030	642	0.190	3	
		24	0.025	404	0.180	3	
		26	0.020	254	0.165	3	
2	A,B, & C (See Note 1)	13 (See Note 2)	Resistance per 100 feet of duplex wire =8.00 ohms +0.00, -0.80 ohms at +25°C		0.335	12	5.5/100ft
3	A,B, & C (See Note 1)	10 (See Note 2)	Resistance per 200 feet of duplex wire = 8.00 ohms +0.00, -0.80 ohms at +25°C		0.405	15	18/200ft

Note 1: Type 1, Classes C, E, H, and J, and Types 2 and 3 are duplex (2 conductor) wire.
Note 2: Wire size shown is approximate to facilitate part numbering.

TABLE II. Corresponding Values of Temperature and Electromotive Force
Reference Junction Temperature 0 Degrees Centigrade

Temperature		Electro-motive Force, mv	Temperature		Electro-motive Force, mv	Temperature		Electro-motive Force, mv
°C	°F		°C	°F		°C	°F	
-200	-328	-8.27	200	392	10.99	600	1112	33.27
-190	-310	-8.02	210	410	11.56	610	1130	33.86
-180	-292	-7.75	220	428	12.12	620	1148	34.45
-170	-274	-7.48	230	446	12.68	630	1166	35.04
-160	-256	-7.14	240	464	13.23	640	1184	35.64
-150	-238	-6.80	250	482	13.79	650	1202	36.24
-140	-220	-6.44	260	500	14.35	660	1220	36.84
-130	-202	-6.06	270	518	14.90	670	1238	37.45
-120	-184	-5.66	280	536	15.46	680	1256	38.06
-110	-166	-5.25	290	554	16.01	690	1274	38.68
-100	-148	-4.82	300	572	16.56	700	1292	39.30
-90	-130	-4.38	310	590	17.12	710	1310	39.93
-80	-112	-3.93	320	608	17.67	720	1328	40.56
-70	-94	-3.47	330	626	18.22	730	1346	41.19
-60	-76	-3.00	340	644	18.77	740	1364	41.83
-50	-58	-2.52	350	662	19.32	750	1382	42.48
-40	-40	-2.03	360	680	19.87	760	1400	43.12
-30	-22	-1.53	370	698	20.42	770	1418	43.77
-20	-4	-1.03	380	716	20.97	780	1436	44.42
-10	14	-0.52	390	734	21.52	790	1454	45.07
0	32	0.00	400	752	22.07	800	1472	45.72
10	50	0.52	410	770	22.62	810	1490	46.37
20	68	1.05	420	788	23.17	820	1508	47.03
30	86	1.58	430	806	23.72	830	1526	47.69
40	104	2.12	440	824	24.27	840	1544	48.34
50	122	2.66	450	842	24.82	850	1562	49.00
60	140	3.20	460	860	25.37	860	1580	49.66
70	158	3.75	470	878	25.92	870	1598	50.32
80	176	4.30	480	896	26.47	880	1616	50.97
90	194	4.85	490	914	27.03	890	1634	51.63
100	212	5.40	500	932	27.58	900	1652	52.29
110	230	5.95	510	950	28.14	910	1670	52.88
120	248	6.51	520	968	28.70	920	1688	53.47
130	266	7.07	530	986	29.26	930	1706	54.06
140	284	7.63	540	1004	29.82	940	1724	54.65
150	302	8.19	550	1022	30.39	950	1742	55.25
160	320	8.75	560	1040	30.96	960	1760	55.84
170	338	9.31	570	1058	31.53	970	1778	56.43
180	356	9.87	580	1076	32.11	980	1796	57.03
190	374	10.43	590	1094	32.69	1000	1832	58.22

TABLE III. Electromotive Force Tolerance

Type	Class	Temperature Range	Tolerance - mv
1	A,B,C,D, and E	-70°C (-94°F) to but not including +150°C (+302°F)	±0.03
		+150°C (+302°F) to but not including +300°C (+572°F)	±0.06
		+300°C (+572°F) to +500°C (+932°F)	±0.10
1	F,G,H,I, and J	-70°C (-94°F) to but not including +300°C (+572°F)	±0.06
		+300°C (+572°F) to +500°C (+932°F)	±0.12
2 and 3	A and C	-70°C (-94°F) to +100°C (+212°F)	±0.12
2 and 3	B	-70°C (-94°F) to but not including +100°C (+212°F)	±0.12
		+100°C (212°F) to +230°C (+446°F)	±0.24

3.3.2.3 Covering. (individual conductors).

3.3.2.3.1 General. The covering, if used, shall consist of a braid, fibrous covering, or other approved material placed over the primary insulation. The covering shall be saturated with a non-hygroscopic and flame-retardant compound which will not affect the color of the braid to such an extent that the colors cannot be easily distinguished. The saturating compound shall bond the covering sufficiently to prevent fraying under normal conditions of installation.

3.3.2.3.2 Color. The covering of the conductors or the primary insulation where the covering is not used shall be color coded in accordance with MIL-STD-687 for Air Force Applications.

3.3.2.4 Duplexing outer covering.

3.3.2.4.1 General. Each duplex wire shall have the individual insulated conductors laid side by side and covered with a braid, fibrous covering, or other approved material.

3.3.2.4.2 Color. The duplexing outer covering of the wire shall be color coded in accordance with MIL-STD-687 for Air Force Applications.

3.3.2.5 Outer protective coating. The outer surface of the wire shall be coated with a compound that is transparent, flexible, non-flammable, or slow-burning, and not materially affected by oil, salt water, ethylene glycol, motor fuels, or alcohol. Adjacent layers of wire wound on reels shall not stick to one another at any temperature under +70°C. The finished wire shall have an even, smooth finish.

3.3.3 Finished wire.

3.3.3.1 Length.

3.3.3.1.1 Type 1. The quantity of wire specified in the contract or purchase order shall be furnished in one continuous length, unless otherwise specified by the procuring activity. Classes A, B, D, F, G, and I iron and constantan wire comprising the lot or order shall be furnished by the same manufacturer and shall be furnished on separate coils or reels.

3.3.3.1.2 Types 2 and 3. The wire shall be furnished in coils or reels of continuous length of 500 to 1,000 feet, unless otherwise specified by the procuring activity.

3.3.3.1.3 Tolerance. The length of the wire supplied in each coil or reel shall not vary more than -5 or +10 percent of the value specified.

3.3.3.2 Color. All colors of finished wire shall be distinctive, reasonably permanent and resistant to the solvents listed in section 4. If the colors can be distinguished, they shall not be considered as faded.

3.3.3.3 Resistance. The resistance of finished Type 2 and Type 3 wire, when calculated to two decimal places shall be as specified in table I (see 4.6.2).

3.3.3.4 Diameter. The diameter of the finished wire shall not exceed the dimensions given in table I.

3.3.3.5 Weight. The weight of the finished wire shall not exceed the values given in table I.

3.4 Performance.

3.4.1 Dielectric strength. The wire shall be capable of withstanding a potential of 350v rms at a commercial frequency for 5 minutes without breakdown or flashover when tested as specified (see 4.6.5).

3.4.2 Insulation resistance. The insulation resistance of the finished wire shall be not less than 100 megohms for 1,000 feet at a temperature of 15.5°C when tested as specified (see 4.6.6).

3.4.3 Temperature aging. The wire shall be aged for a period of 96 hours as specified (see 4.6.7). After which the wire shall be subjected to the bend test (see 4.6.8) and then meet the requirements of 3.4.1 and 3.4.2.

3.4.4 Cold bend. The wire shall withstand a temperature of -55° ±2°C without cracking of the insulation or of the outer protective coating when tested as specified (see 4.6.9). After which the wire shall meet the requirements of 3.4.1.

3.4.5 Heat resistance.

3.4.5.1 Types 2 and 3, class A. Types 2 and 3, class A wire shall withstand a temperature of +120° ±2°C without cracking of the insulation or outer protective coating when tested as specified (see 4.6.10.1). After which the wire shall meet the requirements of 3.4.1.

3.4.5.2 Types 2 and 3, class B. Types 2 and 3, class B wire shall withstand a temperature of +230° ±2°C without cracking of the insulation or outer protective coating when tested as specified (see 4.6.10.2). After which the wire shall meet the requirements of 3.4.1.

3.4.6 Flammability. When tested as specified (see 4.6.11) the rate of burning shall not exceed 1 inch per minute and during the test no burning or charred particles shall fall from the wire.

3.4.7 Solvent resistance. When tested as specified (4.6.12) there shall be no deterioration of the insulation or of the outer protective coating. After which the wire shall meet the requirements of 3.4.1 and 3.4.2.

3.4.8 Fungus resistance. The wire shall show no evidence of fungus growth when tested as specified (see 4.6.13). After which the wire shall meet the requirements of 3.4.1.

3.4.9 Abrasion resistance. The wire shall have abrasion resistance sufficient to withstand the test specified (see 4.6.14) without exposing the conductor.

3.5 IDENTIFICATION OF PRODUCT.

3.5.1 Nameplate. Each coil or reel shall be marked with a durable tag, securely attached to the wire, containing the information in accordance with MIL-STD-130. In addition, the following information shall be included:

Wire, Electrical, Iron, Thermocouple

or

Wire, Electrical, Constantan, Thermocouple

or

Wire, Electrical, Iron and Constantan, Thermocouple
(as applicable)

Type

Class

Length feet

Manufacturer's Lot No.

Federal Stock No.

Military Part No.

3.6 Workmanship. The wire shall be constructed and finished in a thoroughly workmanlike manner. Particular attention shall be given to neatness and to freedom of parts from burrs and sharp edges.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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

a. Preproduction inspection (see 4.4).

b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed at room ambient with results corrected to +25°C.

4.4 Preproduction inspection. Unless otherwise specified in the contract or purchase order, preproduction inspection shall be performed by the supplier, after award of contract and prior to production, at a location acceptable to the Government. Preproduction inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. Preproduction approval is valid only on the contract or purchase order under which it is granted, unless extended by the Government to other contracts or purchase orders (see 6.2).

4.4.1 Sample size. Preproduction inspection sample(s) shall consist of 50 feet of each type and class of wire on contract or purchase order.

4.4.2 Inspection routine. The samples shall be subjected to the inspections specified in Table IV as described under 4.6 Methods of examination and test.

Table IV. Preproduction Inspection Routine

Type	1	2	3
Class	ABCDEFGHIJ	ABC	ABC
Examination of product	XXXXXXXXXX	XXX	XXX
Conductor Timing		XX	XX
Electromotive Force	XXXXXXXXXX	XXX	XXX
Resistance		XXX	XXX
Dielectric Strength	XXXX XXXX	XXX	XXX
Insulation Resistance	XXXX XXXX	XXX	XXX

TABLE IV (Con't)

Type	1	2	3
Class	ABCDEFGHIJ	ABC	ABC
Temperature Aging	XXXX XXXX	XXX	XXX
Bend	XXXX XXXX	XXX	XXX
Cold Bend	XXXX XXXX	XXX	XXX
Heat resistance (+120°C)		X	X
Heat resistance (+230°C)		X	X
Flammability	XXXX XXXX	XXX	XXX
Solvent Resistance	XXXX XXXX	XXX	XXX
Fungus Resistance	XXXX XXXX	XXX	XXX
Abrasion Resistance	XXXX XXXX	XXX	XXX

X = Applicable inspection

4.4.3 Preproduction test report. A preproduction test report in accordance with MIL-STD-831 shall be submitted to the procuring activity with the preproduction inspection sample for approval after completion of testing. The contractor shall not begin production until the test report and samples are approved by the procuring activity (see 6.2).

4.5 Quality conformance inspection. Quality conformance inspection shall consist of:

a. Individual inspections (see 4.5.1).

b. Sampling plans and tests (see 4.5.2).

4.5.1 Individual inspection. The wire shall be subjected to the following inspections as described under 4.6 Methods of examination and test.

a. Examination of product

b. Conductor tinning

c. Electromotive force

d. Resistance (Type 2 and 3 wire)

e. Dielectric strength

f. Insulation resistance

4.5.2 Sampling plans and tests.

4.5.2.1 Sampling plan A. Unless otherwise specified by the procuring activity, for each 50,000 feet of wire for controlled inspected stocks on contract(s) or order(s), a total of 12 samples shall be selected at random from the shipping coils and reels. Not more than 3 samples shall be selected from any one coil or reel if 4 or more coils or reels are supplied. The number of samples for each test shall be as specified in the test methods. The samples shall be subjected to the tests listed below. Any number of contracts or orders may be supplied on the basis of the results of one series of sampling tests provided that all of the wire is of the same type and class, is part of a batch previously sampled, and is submitted for shipment within 24 months after the sampling tests are conducted. If identical insulation is used on a number of classes of wire that are manufactured and submitted for test at substantially the same time, the inspector shall so select the samples as to get at least 3 samples from each class of wire. Only one series of sampling tests is required for each 50,000 feet total of the various classes of wire.

a. Individual inspection

b. Temperature aging

c. Heat resistance

d. Flammability

e. Solvent resistance

4.5.2.2 Sampling plan B. Unless otherwise specified by the procuring activity, the following tests shall be conducted on 9 samples, 3 samples for each test selected at random from each 100,000 feet of wire submitted for acceptance. The samples may be taken from more than one contract or order provided that the total number of samples shall not exceed 9. The conditions specified in sampling plan A for samples from two or more contracts or orders and two or more classes of a given type shall apply. Shipments on orders or contracts for the wire from which the samples are taken shall not be delayed pending these tests. However, in the event one or more samples fail any one of the tests that test shall immediately revert to sampling plan A until 50,000 feet of wire of that type and class have been manufactured with satisfactory test results. These tests shall be completed with satisfactory results prior to any additional shipments of wire in excess of 100,000 feet of the type and class(es) sampled.

a. Sampling plan A tests

b. Cold bend

c. Fungus

d. Abrasion resistance

4.5.2.3 Rejection and retest. When one sample selected from a production run fails to meet the specification, no wire from which the sample was taken shall be accepted until the extent and cause of failure are determined. This applies to all wire of the same batch or lot for individual and sampling plan A tests.

4.5.2.3.1 Individual tests may continue. For operational reasons, individual tests may be continued pending the investigation of a sampling test failure. But final acceptance of items on hand or later produced shall not be made until it is determined that the wire meets all the requirements of individual and sampling plan A tests. Additional sampling tests shall be conducted. If a failure occurs during these tests the sampling test shall immediately revert to individual tests until the batch is tested.

4.5.3 Defects in items already accepted. The investigation of a test failure could indicate that defects may exist in items already accepted. If so, the contractor shall fully advise the procuring activity of all defects likely to be found and methods of correcting them.

4.6 Methods of examination and test.

4.6.1 Examination of product. The wire shall be subjected to a thorough general inspection to ascertain that the materials, workmanship, and design are in strict conformity with the requirements of this specification. The general inspection shall cover the requirements such as dimensions, color coding, weight, conformity of materials to specification requirements, and ease of insulation stripping.

4.6.2 Conductor tinning. The continuity of the tin coating of the unassembled strand of iron shall be determined for three specimens. The specimens shall be approximately 6 inches in length and shall be tagged or marked to identify them with the coil or reel from which they were cut.

4.6.2.1 Treatment of specimens. The specimens shall be thoroughly cleaned by immersion in benzine, redistilled petroleum ether or ether for at least 3 minutes, then removed and wiped dry with a clean soft cloth. The specimens thus cleaned shall be kept wrapped in a clean soft cloth. That portion of the specimen to be immersed in the test solution shall not be handled. Care shall be taken to avoid abrasion by the cut ends.

4.6.2.1.1 Ferroxyl test solution. A solution shall be made by thoroughly dissolving 60 grams of sodium chloride, c.p. (NaCl), and 10 grams of agar-agar in 1 liter of distilled water heated to approximately 90°C. The solution shall then be cooled to room temperature to form a gel. Before the solution gels, a 0.5 gram of potassium ferricyanide ($K_3Fe(CN)_6$) shall be thoroughly dissolved in the solution. The test solution shall be considered exhausted when it fails to blue a piece of clean iron wire immersed in the solution.

4.6.2.2 Procedure. A length of at least 4 1/2 inches from each of the clean specimens shall be immersed in accordance with the following cycle, with the test solution maintained at approximately room temperature (25°C).

a. The specimen shall be thoroughly washed in distilled water and allowed to air dry.

b. The specimen shall be immersed in the ferroxyl solution for a period of 2 minutes.

After the 2-minute immersion in the ferroxyl solution and while still in the solution, the specimen shall be examined to ascertain if iron exposed through openings in the tin coating has turned blue by action of the ferroxyl solution. The specimen shall be considered to have failed if, by such bluing, exposed iron is revealed. No attention shall be paid to bluing within 0.5 inch of the cut end.

4.6.3 Electromotive force.

4.6.3.1 Type 1, classes A, B, C, D, and E wire. A thermocouple shall be formed from a specimen of the wire taken from each coil or reel. The electromotive force characteristics of the wire shall be determined at temperatures of -50°, 0°, +100°, +200°, +300°, and +500°C. The measured electromotive force shall be as specified in table III.

4.6.3.2 Type 1, classes F, G, H, I, and J: types 2 and 3, classes A, B, and C wire. A thermocouple shall be formed from the wire, and the electromotive force characteristics of the wire shall be determined at temperatures of 0°, +50°, and +100°C. The measured electromotive force shall be as specified in table III. One specimen shall be taken from each coil or reel.

4.6.4 Resistance. The total resistance (iron and constantan conductor) of each finished coil or reel of wire shall be determined at, or the determined resistance corrected to +25°C and shall be expressed as resistance per 100 feet for type 2 wire and resistance per 100 feet for type 2 wire and resistance per 200 feet for type 3 wire (see 3.3.3.3). A certificate showing the results of the resistance test shall be furnished by the contractor with each coil or reel. The certificate shall state the resistance to two decimal places calculated for a length of 100 or 200 feet as applicable for +25°C, date of test, and name of person performing the test. In making this test, care shall be exercised so that any thermal electromotive force developed by joining the iron and constantan wire does not affect the results. The following expression may be used for converting resistances measured at temperatures other than +25°C to resistance to +25°C:

Iron conductor

$$R_{25} = \frac{192.31\ R_t}{167.31 + t}$$

Constantan conductor

$$R_{25} = \frac{500.000R_t}{499.975 + t}$$

Where R_{25} = Resistance at +25°C
R_t = Resistance at temperature (t) in ohms
t = Temperature at which resistance was measured in degrees Centigrade

4.6.5 Dielectric strength. One inch of the insulation shall be removed from each end of three 36-inch specimens of the wire. The samples shall be immersed in a saturated solution of salt water, at a temperature of +25°C, to a point 6 inches from each end of the insulation for a period of 20 hours. Following this period, a potential of 350V rms at a commercial frequency shall be applied to the specimen. The potential shall be applied to the specimen through grounding the outer surface of the insulation by immersion in the salt solution at not over +30°C and the voltage applied between each conductor and ground. The wire shall be capable of withstanding this potential for 5 minutes without breakdown (see 3.4.1).

4.6.6 Insulation resistance. The samples of wire, subjected to the dielectric strength test shall then be subjected to the insulation resistance test. Insulation resistance measurements shall be made with a megohm bridge or with a galvanometer and a suitable source of direct current. The measurement shall be made with the specimen immersed in a saturated solution of salt water, at a temperature of +25°C, to a point 6 inches from each end of the insulation. The insulation resistance shall be determined between each conductor and ground after 1 minute electrification with a potential of not less than 200 nor more than 500V dc. During this test, the temperature of the wire shall be as nearly uniform as practicable. The measured insulation resistance shall be corrected to a reference temperature of +15.5°C by multiplying the measured value of insulation resistance by a coefficient corresponding to the temperature of the measurement. These temperature coefficients are shown in table V. For temperature values between those tabulated, the coefficients for the next higher temperature shall be used when above +15.5°C and that of the next lower temperature shall be used when below. For approved insulating materials possessing temperature coefficients not within the limits set by this reference characteristics, the values applicable thereto may be used when specifically approved by the procuring activity (see 3.4.2).

4.6.7 Temperature aging. One inch of the insulation shall be removed from each end of a 36-inch specimen of the finished wire. The specimen shall be suspended in a suitable test chamber without touching the walls of the chamber. The chamber shall be maintained at a temperature of +100°, ±2°C. The heated air, at atmospheric pressure, in the chamber shall be circulated so as to maintain a uniform temperature. The specimen shall be subjected to this temperature for a period of 96 hours and then subjected to the bend, dielectric, and insulation resistance tests, respectively (see 3.4.3).

TABLE V. Temperature Coefficients.

Temperature		Temperature Coefficients of Insulation	Temperature		Temperature Coefficients of Insulation
Degrees F	Degrees C		Degrees F	Degrees C	
32	0.0	0.032	65	18.3	1.80
35	1.7	0.047	68	20.0	2.50
38	3.3	0.071	71	21.7	3.50
41	5.0	0.098	74	23.3	5.00
44	6.7	0.140	77	25.0	6.60
47	8.3	0.25	80	26.7	8.30
50	10.0	0.29	83	28.3	11.0
53	11.7	0.45	86	30.0	17.5
56	13.3	0.78	89	31.7	24.5
59	15.0	0.91	92	33.3	34.0
60	15.5	1.00	95	35.0	48.0
62	16.7	1.26			

4.6.8 Bend. One end of the specimen shall be secured to a mandrel and the other end to the load weight specified in table VI. The mandrel shall be rotated until the full length of the specimen is wrapped around the mandrel and is under the specified tension with adjoining coils in contact. The mandrel shall then be rotated in the reverse direction until the full length of the specimen is wrapped around the mandrel as before, except that the reverse surface of the wire is in contact with the mandrel. This procedure shall be repeated until two bends in each direction have been formed in the same section of the wire. When this test is conducted on duplex wire, the bend shall be made on the minor diameter of the wire.

TABLE VI. Bend Diameters and Loads.

Gage	Mandrel Diameter (Inches) Bend Test and Cold Bend Test	Maximum Test Load (lb) Bend Test
14	3	1.0
16	3	1.0
18	2	1.0
20	2	0.75
22	2	0.75
24	1	0.75
26	1	0.75
28	1	0.50
30	1	0.50
Type 2 Classes A,B, and C	3	1.0
Type 3 Classes A,B, and C	3	3.0

4.6.9 Cold bend. Three straight specimens of the finished wire shall be prepared by removing 1 inch of insulation at each end to the bare conductor. The wire shall be subjected to a temperature of -55°C for a period of 4 hours. At the end of this period and while still at -55°C, the specimens shall be wrapped about a mandrel mounted within the cold chamber as specified in table VI, at the rate of one turn in 4 seconds, for a sufficient number of turns so that the center portion of the wire is subjected to at least two complete turns. The specimen shall be unwrapped and rewrapped in the opposite direction in a similar manner. Either a revolving or stationary mandrel may be used. The specimen shall then be removed from the mandrel and, without straightening, shall then be subjected to and meet the requirements of the dielectric test as specified herein. When the test is conducted on duplex wire, the bend shall be made on the minor diameter of the wire (see 3.4.4).

4.6.10 Heat resistance.

4.6.10.1 *Types 2 and 3, class A.* A specimen of finished wire shall be prepared by removing 1 inch of insulation at each end to the bare conductor. The specimen shall be placed in an oven maintained at +120° ±2°C for 24 hours. At the end of this time, the specimen shall be removed and allowed to return to room temperature. The specimen shall then be wound tightly around a mandrel five times the major diameter of the wire for five close turns and removed without straightening. The coiled section shall then be subjected to and meet the requirements of the dielectric test as specified herein. When this test is conducted on duplex wire the bend shall be made on the minor diameter of the wire (see 3.4.5.1).

4.6.10.2 Types 2 and 3 class B. A specimen of finished wire shall be prepared by removing 1 inch of insulation at each end to the bare conductor. The specimen shall be placed in an oven maintained at +230° ±5°C for 24 hours. At the end of this time, the specimen shall be removed and allowed to return to room temperature. The specimen shall then be wound tightly around a mandrel three times the outside diameter of the wire for five close turns and removed without straightening. The coiled section shall then be subjected to and meet the requirements of the dielectric test as specified herein (see 3.4.5.2).

4.6.11 Flammability. A 20-inch length of the finished wire shall be marked with fine threads at distances 5 and 11 inches from one end of the specimen to designate a 6-inch test length. The specimen shall be held tautly in a horizontal position within a chamber approximately 2 by 1 foot, open at the top and one long side, and which allows sufficient flow of air for complete combustion but which is free from drafts. A flame from a Bunsen burner shall be applied for 30 seconds to the end of the specimen from which distances were measured, and then removed. The Bunsen burner shall have a 1/4 inch inlet, a nominal bore of 3/8-inch, and a length of approximately 4 inches from top to primary inlets. The burner shall be adjusted to produce a 2-inch flame with an inner cone 1/3 of the flame height. The burner height shall be so adjusted that the hottest portion of the flame is applied to the wire. The time of burning shall then be recorded as the time required for the flame to progress along the marked 6-inch length (see 3.4.6).

4.6.12 Solvent resistance. Five specimens of finished wire, each 2 feet long, shall be prepared by removing 1 inch of insulation at each end to the bare conductor. The center 1-foot section of the specimen shall be immersed in the solvents listed in table VII for 24 hours at +25°C, removed, and wiped clean with a dry cloth. Any one specimen shall not be immersed in more than one solvent. The center 1-foot section shall be subjected to and meet the requirements of the dielectric and insulation resistance tests specified herein. All specimens shall be immersed in the salt water specified for dielectric test and tested immediately with no soaking required (see 3.4.7).

TABLE VII. Test Solvents

Solvent	Spec
Saturated solution of salt water	----------
Ethylene glycol	O-A-548
Isopropyl alcohol	TT-I-735
Standard test fluid type II	TT-S-735
Engine oil grade 1065	MIL-L-6082"

4.6.13 Fungus. Three specimens of finished wire, each 2 feet long, shall be prepared by removing 1 inch of insulation from each end to the bare conductor. The specimens shall be subjected to the fungus test, Method 508, in accordance with MIL-STD-810. At the completion of the exposure period, the specimen shall be examined for evidence of fungus growth. There shall be no evidence of fungus growth on the specimen. The center 1-foot section, within 15 minutes after removal from the test chamber, shall be subjected to and meet the requirements of the dielectric test as specified herein (see 3.4.8).

4.6.14 Abrasion resistance. Three specimens of finished wire, each 2 feet long, shall be subjected to the abrasion test. The specimens shall be tested with an abrasion tester conforming to MIL-T-5438. The length of abrasive tape, the weight applied and support bracket used shall be as specified in Table VIII. Only the finished insulation of the individual conductors, not duplexing outer covering, of duplex wire shall be subjected to the abrasion resistance test (see 3.4.9).

TABLE VIII. Abrasion Resistance

American Wire Gage	Length of Tape-Inches	Weight Lb	Support Bracket
30	10	1.0	A
28	12	1.0	A
26	16	1.0	A
24	16	1.0	A
22	16	1.0	A
20	16	1.0	A
18	16	1.0	A
16	22	1.0	A
14	10	3.0	B
13	10	3.0	B
12	10	3.0	B
10	15	3.0	B
8	19	3.0	B
6	21	3.0	C

4.7 Inspection of the preservation, packaging, packing and marking for shipment and storage. The inspection of the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, and packing. Unless otherwise specified, the wire shall be preserved, packaged, and packed in accordance with MIL-C-12000.

5.2 Marking and labeling.

5.2.1 Reels. Each reel shall be plainly marked on both ends with the information listed below. If paper labels are used, they shall be securely attached to the reels, and shall be protected by a transparent compound to prevent deterioration of markings:

Wire, Electrical, Iron, Thermocouple

or

Wire, Electrical, Constantan, Thermo couple

or

Wire, Electrical, Iron and Constantan, Thermocouple (as applicable)

Specification MIL-W-5845

Type

Class

Conductor size (Type 1 only)

Length

Number of Conductors (Type 1 only)

Manufacturer's Part No.

Military Part No.

Manufacturer's Lot No. (Type 1 Classes A,B,D,F,G, and I only)

Contract or Order No.

Federal Stock No.

Date of Manufacture

Manufacturer's Name or Trade-Mark

Name of Contractor (if not the same as manufacturer)

5.2.2 Coils. Each coil shall be plainly marked with the same information as required on the reels.

5.2.3 Packages. Each interior package containing type 1, classes A,B,D,F,G, and I, iron and constantan wire shall be plainly marked with the following information:

Caution: Iron and constantan wire contained herein is calibrated for use together in fabricating thermocouples. If different lot numbers are used for thermocouple fabrication, recalibration of wire will be required.

5.2.4 Shipping containers. Each shipping container shall be marked in accordance with the requirements applicable to the individual services, as specified in MIL-STD-129.

6. NOTES

6.1 Intended use.

6.1.1 Type 1 classes A,B,C,D, and E wire. Type 1, classes A,B,C,D, and E wire are intended for use in fabricating thermocouples where high accuracy electromotive force calibration is required.

6.1.2 Type 1, class F,G,H,I, and J wire. Type 1, class F,G,H,I, and J wire are intended for use in fabricating thermocouples where nominal accuracy electromotive force calibration is required.

6.1.3 Types 2 and 3, class A wire. Types 2 and 3, class A wire are intended for fabrication thermocouple extension leads for aircraft use. The wire is intended for applications where temperatures of +120°C are to be encountered.

6.1.4 Types 2 and 3, class B wire. Types 2 and 3, class B wire are intended for fabricating thermocouple extension leads for aircraft use. The wire is intended for applications where temperatures of +230°C are to be encountered.

6.1.5 Types 2 and 3, class C wire. Types 2 and 3, class C wire are intended for general laboratory use where conditions do not require that the iron wire be protected against corrosion.

6.2 Ordering data. Procurement documents should specify the following:

6.2.1 Procurement requirements.

a. Title, number and date of this specification.

b. Military part number (see 1.2.1).

c. Unless otherwise specified a preproduction test sample is required (see 3.1).

e. Levels of preservation, packaging, and packing (see 5.1).

6.2.2 Contract data requirements. Data conforming to Data Item Description DI-T-3718/T-119-2 will usually be required for delivery in connection with this specification. When so required, such data will be specified for delivery on a DD Form 1423 included in the contract or purchase order (see 4.4.3).

6.3 Preproduction. The preproduction sample shall be examined and tested for approval at the contractor's plant or at an independent commercial testing laboratory acceptable to the procuring activity. Preproduction tests shall be witnessed by a Government representative of the procuring activity. Approval of the preproduction sample shall be by the contracting officer.

6.4 Marginal indicia. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - EL
Navy - AS
Air Force - 80

Review activities:
Army - GL, EL
Navy - AS, OS
DSA - IS

User activities:
Army - AT, MU
Navy - OS

Preparing activity:
Air Force - 80

(Project 6145-0630)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

OMB Approval
No. 22-R255

INSTRUCTIONS: The purpose of this form is to solicit beneficial comments which will help achieve procurement of suitable products at reasonable cost and minimum delay, or will otherwise enhance use of the document. DoD contractors, government activities, or manufacturers/ vendors who are prospective suppliers of the product are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.

DOCUMENT IDENTIFIER AND TITLE

NAME OF ORGANIZATION AND ADDRESS

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3. IS THE DOCUMENT RESTRICTIVE?

☐ YES ☐ NO *(If "Yes", in what way?)*

4. REMARKS

SUBMITTED BY *(Printed or typed name and address - Optional)*

TELEPHONE NO.

DATE

DD FORM 1 JAN 72 1426

REPLACES EDITION OF 1 JAN 68 WHICH MAY BE USED

S/N 0102-014-1802