INCH-POUND
J-W-1177/40
June 10, 1988

FEDERAL SPECIFICATION SHEET

WIRE, MAGNET, ELECTRICAL, CLASS 180, TYPE SPEIN, SOLDERABLE POLYESTER-IMIDE, OVERCOATED WITH POLYAMIDE, ROUND

This specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

The requirements for acquiring the wire described herein shall consist of this specification and the latest issue of J-W-1177.

Classification:	Class 180; type SPEIN (single), type SPEIN2 (heavy); round.
Insulating materials:	The conductor shall be coated with a dual film. The underlying coating shall be based on a solderable polyester-imide resin. The superimposed coating shall be based on a polyamide resin.
NEMA/ANSI equivalent:	All test requirements are equivalent to MW-78 of NEMA MW 1000.
General requirements:	See J-W-1177 for general requirements, quality assurance provisions, and packaging.

Requirements:

Characteristics	Test procedure, see J-W-1177	Wire sizes, AWG	Requirements
Dimensions	4.7.1.2	14-44	See table I.
Adherence and flexibility	4.7.2.1	14-44	No cracks visible in the film coating.
Elongation	4.7.5	14-44	Not less than the value in table II.
Heat shock	4.7.4	14-44	No cracks visible in the coating after conditioning as shown in table III.

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Requirements: (Continued)

Characteristics	Test procedure, see J-W-1177	Wire sizes, AWG	Requirements
Scrape resistance	4.7.6	14-30	Lowest grams-to-fail load for any of the three tests and the average of the three tests shall be not less than the values in table IV.
Springback	4.7.7	14-30	Not greater than the value in table V.
Dielectric strength	4.7.9	14-44	Not less than the value in table VI.
Continuity	4.7.10	31-44	The number of discontinuities shall be not greater than the number listed in table VII.
	4.7.11	14-30	
Thermoplastic flow	4.7.8	18, 36	Median not less than 200°C with heavy film coated wire.
Solubility	4.7.12	18, 36	Heavy film coated wire shall not soften sufficiently to expose bare conductor when immersed in xylene.
Dielectric strength at temperature	4.7.14	18, 36	Heavy film coated wire shall average not less than 3825 volts for 18 AWG 1900 or 1725 volts for 36 AWG.
Thermal endurance	4.7.15.1	18	155°C minimum with heavy film coated wire.
	4.7.15.2	14-44	1000 volts/mil minimum after 168 hours at 200°C.
		14-44	200°C minimum.
Solderability	4.7.17	14-44	Covered with continuous film of solder and not readily separable after soldering as shown in table VIII.

TABLE I. Dimensions.

AWG size	Bare wire diameter, inch			Type SPEIN		Type SPEIN2	
	Minimum	Nominal	Maximum	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch
14	0.0635	0.0641	1/0.0644	0.0016	0.0666	0.0032	0.0682
15	.0565	.0571	1/ .0574	.0015	.0594	.0030	.0609
16	.0503	.0508	1/ .0511	.0014	.0531	.0029	.0545
17	.0448	.0453	1/ .0455	.0014	.0475	.0028	.0488
18	.0399	.0403	1/ .0405	.0013	.0424	.0026	.0437
19	.0355	.0359	1/ .0361	.0012	.0379	.0025	.0391
20	.0317	.0320	1/ .0322	.0012	.0339	.0023	.0351
21	.0282	.0285	1/ .0286	.0011	.0303	.0022	.0314
22	.0250	.0253	1/ .0254	.0011	.0270	.0021	.0281
23	.0224	.0226	1/ .0227	.0010	.0243	.0020	.0253
24	.0199	.0201	1/ .0202	.0010	.0217	.0019	.0227
25	.0177	.0179	1/ .0180	.0009	.0194	.0018	.0203
26	.0157	.0159	1/ .0160	.0009	.0173	.0017	.0182
27	.0141	.0142	.0143	.0008	.0156	.0016	.0164
28	.0125	.0126	.0127	.0008	.0140	.0016	.0147
29	.0112	.0113	.0114	.0007	.0126	.0015	.0133
30	.0099	.0100	.0101	.0007	.0112	.0014	.0119
31	.0088	.0089	.0090	.0006	.0100	.0013	.0108
32	.0079	.0080	.0081	.0006	.0091	.0012	.0098
33	.0070	.0071	.0072	.0005	.0081	.0011	.0088
34	.0062	.0063	.0064	.0005	.0072	.0010	.0078
35	.0055	.0056	.0057	.0004	.0064	.0009	.0070
36	.0049	.0050	.0051	.0004	.0058	.0008	.0063
37	.0044	.0045	.0046	.0003	.0052	.0008	.0057
38	.0039	.0040	.0041	.0003	.0047	.0007	.0051
39	.0034	.0035	.0036	.0002	.0041	.0006	.0045
40	.0030	.0031	.0032	.0002	.0037	.0006	.0040
41	.0027	.0028	.0029	.0002	.0033	.0005	.0036
42	.0024	.0025	.0026	.0002	.0030	.0004	.0032
43	.0021	.0022	.0023	.0002	.0026	.0004	.0029
44	.0019	.0020	.0021	.0001	.0024	.0004	.0027

1/ The maximum bare wire dimensions may be exceeded up to the NEMA/ANSI maximum bare wire limit, provided the minimum increase is maintained and the maximum overall diameter specified is not exceeded.

TABLE II. Elongation.

AWG size	Elongation, minimum percent
14	33
15	33
16	33
17	32
18	32
19	31
20	30
21	30
22	29
23	29
24	28
25	28
26	27
27	27
28	26
29	26
30	25
31	24
32	24
33	23
34	22
35	21
36	20
37	20
38	19
39	18
40	17
41	17
42	16
43	15
44	14

TABLE III. Heat shock.

AWG size	Minimum elongation, percent	Mandrel diameter	Minimum temperature, °C
14-30	20	3X	200
31-44	1/ 20	3X	200

1/ Or to the breaking point, whichever is less.

TABLE IV. Scrape resistance.

AWG size	Type SPEIN		Type SPEIN2	
	Scrape, grams-to-fail		Scrape, grams-to-fail	
	Average	Minimum	Average	Minimum
14	740	630	1310	1120
15	685	585	1230	1045
16	645	550	1155	980
17	605	515	1080	920
18	570	485	1010	860
19	530	450	940	800
20	495	420	880	750
21	460	390	825	705
22	430	365	775	660
23	405	345	720	615
24	380	320	680	575
25	350	300	635	540
26	335	285	595	505
27	310	265	560	475
28	295	250	525	450
29	275	235	495	420
30	260	220	460	395
31	---	---	---	---
32	---	---	---	---
33	---	---	---	---
34	---	---	---	---
35	---	---	---	---
36	---	---	---	---
37	---	---	---	---
38	---	---	---	---
39	---	---	---	---
40	---	---	---	---
41	---	---	---	---
42	---	---	---	---
43	---	---	---	---
44	---	---	---	---

TABLE V. Springback.

AWG size	Springback, maximum degrees per turn
14	42
15	46
16	50
17	54
18	58
19	62
20	66
21	53
22	58
23	62
24	67
25	72
26	76
27	50
28	55
29	61
30	66

TABLE VI. Dielectric strength.

AWG size	Type SPEIN	Type SPEIN2
	Dielectric strength, minimum breakdown volts	Dielectric strength, minimum breakdown volts
14	3175	5700
15	3075	5550
16	3000	5400
17	2925	5275
18	2850	5125
19	2775	5000
20	2700	4850
21	2625	4725
22	2575	4625
23	2500	4500
24	2425	4375
25	2375	4250
26	2300	4150
27	2250	4050
28	2175	3950
29	2150	3825
30	2075	3725
31	1875	3450
32	1675	3175
33	1500	2925
34	1350	2675
35	1200	2475
36	1075	2275
37	975	2100
38	850	1925
39	775	1775
40	700	1625
41	625	1500
42	575	1375
43	500	1250
44	450	1175

TABLE VII. Continuity.

AWG size	Maximum number of discontinuities	
	Type SPEIN	Type SPEIN2
14-24	25	5
25-30	25	7
31-44	25	5

TABLE VIII. Solderability.

AWG size	Maximum immersion time, seconds		Temperature of solder, °C
	Type SPEIN	Type SPEIN2	
14-15	8	8	480
16-19	8	8	455
20-29	6	6	455
30-36	5	5	455
37-44	4	4	455

Part number: Magnet wire covered by this specification shall be defined by the following part numbering system. Example: M1177/40-02C029.

M1177/40-	02	C	029
Federal specification identifier	Two digit type code	Single letter conductor code	Three character size code

The following codes shall apply:

Type	Type code	Conductor	Conductor code
SPEIN	01	Copper	C
SPEIN2	02	Aluminum	A
		Nickel-coated copper	N
		Silver-coated copper	S

The size code shall be the bare wire dimension. AWG wire size shall be used.

Intended use: Type SPEIN magnet wire is intended for use in 180°C applications where solderability and good windability are desired.

MILITARY INTERESTS:

Custodians:
Army - CR
Navy - SH
Air Force - 85

Review activities:
Army - AR, ER, MI
DLA - IS

User activities:
Army - ME
Navy - AS, CG, MC, OS

CIVIL AGENCY COORDINATING ACTIVITIES:

GSA - FSS, PBO, PCD
INTERIOR - BLM
HHS - FDA
DCGOVT - DCG
NASA - JFK
COMMERCE - NBS
TRANSPORTATION - APM, FAA

Preparing activity:
Navy - SH
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