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INCH-POUND
J-W-1177/12B
June 10, 1988
SUPERSEDING
J-W-1177/12A
September 27, 1976

FEDERAL SPECIFICATION SHEET

WIRE, MAGNET, ELECTRICAL, CLASS 180, TYPE H, POLYESTER-IMIDE OR POLYESTER-AMIDE-IMIDE, 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 H (single), type H2 (heavy), type H3 (triple); round.

Insulating materials: The film shall be based on a polyester-imide or polyester-amide-imide resin.

NEMA/ANSI equivalent: All test requirements except thermal endurance are equivalent to MW-30 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	4-56	See tables I and II.
Adherence and flexibility	4.7.2.1	4-56	No cracks visible in the film coating.
Elongation	4.7.5	4-50	Not less than the value in table III.
Heat shock	4.7.4	4-44	No cracks visible in the coating after conditioning as shown in table IV.

AMSC N/A FSC 6145

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Requirements: (Continued)

Characteristics	Test procedure, see J-W-1177	Wire sizes, AWG	Requirements
Scrape resistance	4.7.6	10-30	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 V.
Springback	4.7.7	14-30	Not greater than the value in table VI.
Dielectric strength	4.7.9	4-44	Not less than the value in table VII.
Continuity	4.7.10 4.7.11	31-56 14-30	The number of discontinuities shall be not greater than the number listed in table VIII.
Thermoplastic flow	4.7.8	18, 36	Median not less than 300°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 or 50/50 parts by volume xylene/ethyl Cellosolve.
Dielectric strength at temperature	4.7.14	18, 36	Heavy film coated wire shall average no less than 4275 volts for 18 AWG or 1900 volts for 36 AWG.
Thermal endurance	4.7.15.1	18	180°C minimum with heavy film coated wire.
	4.7.15.2	4-44	1000 volts/mil minimum after 168 hours at 250°C.
	4.7.15.3	4-44	200°C minimum as shown in table IV.

TABLE I. Dimensions, sizes 4 to 44 AWG.

AWG size	Bare wire diameter, inch			Type H, single		Type H2, heavy		Type H3, triple	
	Minimum	Nominal	Maximum	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch
1/ 4	0.2023	0.2043	0.2053	----	----	0.0037	0.2098	----	----
1/ 5	.1801	.1819	.1828	----	----	.0036	.1872	----	----
1/ 6	.1604	.1620	.1628	----	----	.0035	.1671	----	----
1/ 7	.1429	.1443	.1450	----	----	.0034	.1491	----	----
1/ 8	.1272	.1285	.1292	----	----	.0033	.1332	----	----
1/ 9	.1133	.1144	.1150	----	----	.0032	.1189	----	----
1/10	.1009	.1019	.1024	----	----	.0031	.1061	----	----
1/11	.0898	.0907	.0912	----	----	.0030	.0948	----	----
1/12	.0800	.0808	.0812	----	----	.0029	.0847	----	----
1/13	.0713	.0720	.0724	----	----	.0028	.0757	----	----
1/14	.0635	.0641	.0644	0.0016	0.0666	.0032	.0682	0.0048	0.0700
1/15	.0565	.0571	.0574	.0015	.0594	.0030	.0609	.0045	.0627
1/16	.0503	.0508	.0511	.0014	.0531	.0029	.0545	.0043	.0562
1/17	.0448	.0453	.0455	.0014	.0475	.0028	.0488	.0041	.0504
1/18	.0399	.0403	.0405	.0013	.0424	.0026	.0437	.0039	.0452
1/19	.0355	.0359	.0361	.0012	.0379	.0025	.0391	.0037	.0406
1/20	.0317	.0320	.0322	.0012	.0339	.0023	.0351	.0035	.0364
1/21	.0282	.0285	.0286	.0011	.0303	.0022	.0314	.0033	.0326
1/22	.0250	.0253	.0254	.0011	.0270	.0021	.0281	.0032	.0293
1/23	.0224	.0226	.0227	.0010	.0243	.0020	.0253	.0030	.0264
1/24	.0199	.0201	.0202	.0010	.0217	.0019	.0227	.0029	.0238
1/25	.0177	.0179	.0180	.0009	.0194	.0018	.0203	.0027	.0214
1/26	.0157	.0159	.0160	.0009	.0173	.0017	.0182	.0026	.0193
1/27	.0141	.0142	.0143	.0008	.0156	.0016	.0164	.0024	.0173
1/28	.0125	.0126	.0127	.0008	.0140	.0016	.0147	.0023	.0156
1/29	.0112	.0113	.0114	.0007	.0126	.0015	.0133	.0022	.0142
1/30	.0099	.0100	.0101	.0007	.0112	.0014	.0119	.0021	.0128

See footnote at end of table.

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TABLE I. Dimensions, sizes 4 to 44 AWG. - Continued

AWG size	Bare wire diameter, inch			Type H, single		Type H2, heavy		Type H3, triple	
	Minimum	Nominal	Maximum	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch
31	0.0088	0.0089	0.0090	0.0006	0.0100	0.0013	0.0108	----	----
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/ These bare wire diameters may be exceeded, provided:

(a) The maximum diameters specified by QQ-W-343 are not exceeded,
(b) The minimum increases in diameter shown in table I are maintained, and
(c) The maximum overall diameters shown in table I are not exceeded.

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TABLE II. Characteristics of wire, sizes 45 to 56 AWG.

AWG size	Theoretical 1/ nominal bare wire diameter, inch	Conductor resistance at 20°C, ohms per foot			Type H, single		Type H2, heavy	
		Minimum	Nomimnal	Maximum	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch
45	0.00176	3.080	3.348	3.616	0.00010	0.00205	0.00030	0.00230
46	.00157	3.870	4.207	4.544	.00010	.00185	.00030	.00210
47	.00140	4.868	5.291	5.714	.00010	.00170	.00030	.00190
48	.00124	6.205	6.745	7.285	.00010	.00150	.00020	.00170
49	.00111	7.744	8.417	9.090	.00010	.00130	.00020	.00150
50	.00099	9.734	10.58	11.43	.00010	.00120	.00020	.00140
51	.00088	12.32	13.39	14.46	.00010	.00110	----	----
52	.00078	15.69	17.05	18.41	.00010	.00100	----	----
53	.00070	19.48	21.17	22.86	.00005	.00085	----	----
54	.00062	24.82	26.98	29.14	.00005	.00075	----	----
55	.00055	31.54	34.28	37.02	.00005	.00070	----	----
56	.00049	39.73	43.19	46.65	.00005	.00065	----	----

1/ Theoretical nominal bare wire diameters are in accordance with NBS Handbook 100. Conductor diameter tolerances are shown as resistance values and shall be determined by measuring the resistance of the wire in accordance with ASTM B 193, where applicable. A specimen at least 5 feet long shall be used.

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TABLE III. Elongation of finished wire.

AWG size	Minimum elongation, percent	AWG size	Minimum elongation, percent	AWG size	Minimum elongation, percent
4	38	20	30	36	20
5	37	21	30	37	20
6	37	22	29	38	19
7	36	23	29	39	18
8	36	24	28	40	17
9	36	25	28	41	17
10	35	26	27	42	16
11	35	27	27	43	15
12	34	28	26	44	14
13	34	29	26	45	11
14	33	30	25	46	10
15	33	31	24	47	8
16	33	32	24	48	7
17	32	33	23	49	6
18	32	34	22	50	5
19	31	35	21		

TABLE IV. Heat shock.

AWG size	Minimum elongation, percent	Mandrel diameter	Minimum temperature °C
4-9	30	None	200
10-13	25	5X	200
14-30	20	3X	200
31-44	1/ 20	3X	200

1/ Or to breaking point, whichever is less.

TABLE V. Scrape resistance.

AWG size	Type H single coating		Type H2 heavy coating		Type H3 triple coating	
	Average grams-to-fail	Minimum grams-to-fail	Average grams-to-fail	Minimum grams-to-fail	Average grams-to-fail	Minimum grams-to-fail
10	---	---	1490	1270	---	---
11	---	---	1490	1270	---	---
12	---	---	1490	1270	---	---
13	---	---	1490	1270	---	---
14	840	715	1490	1270	1735	1475
15	780	665	1400	1190	1620	1375
16	735	625	1310	1115	1525	1295
17	690	585	1230	1045	1425	1210
18	645	550	1150	900	1335	1135
19	600	510	1070	910	1255	1065
20	560	475	1000	850	1130	1000
21	525	445	940	800	1115	945
22	490	415	880	750	1045	890
23	460	390	820	700	975	830
24	430	365	770	655	910	770
25	400	340	720	615	850	720
26	380	325	675	575	795	675
27	355	300	635	540	735	625
28	335	285	595	510	690	585
29	310	265	560	480	645	550
30	295	250	525	450	605	515

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TABLE VI. Springback of finished wire.

AWG size	Maximum springback, degrees		AWG size	Maximum springback, degrees	
	Types H and H2	Type H3		Types H and H2	Type H3
14	42	46	23	62	64
15	46	49	24	67	69
16	50	53	25	72	74
17	54	58	26	76	80
18	58	62	27	50	55
19	62	66	28	55	60
20	66	70	29	61	65
21	53	53	30	66	70
22	58	58			

TABLE VII. Minimum breakdown voltage.

AWG size	Volts			AWG size	Volts		
	Type H	Type H2	Type H3		Type H	Type H2	Type H3
4	----	3700	----	25	2625	4725	6325
5	----	3600	----	26	2550	4600	6150
6	----	3500	----	27	2500	4500	6000
7	----	3400	----	28	2425	4375	5850
8	----	3300	----	29	2375	4250	5700
9	----	3200	----	30	2300	4150	5550
10	----	6200	----	31	2075	3825	----
11	----	6000	----	32	1850	3525	----
12	----	5800	----	33	1675	3250	----
13	----	5600	----	34	1500	2975	----
14	3525	6325	8450	35	1325	2750	----
15	3425	6175	8225	36	1200	2525	----
16	3325	6000	8000	37	1075	2325	----
17	3250	5850	7800	38	950	2150	----
18	3175	5700	7600	39	850	1975	----
19	3075	5550	7400	40	775	1800	----
20	3000	5400	7200	41	700	1675	----
21	2925	5250	7025	42	625	1525	----
22	2850	5125	6850	43	550	1400	----
23	2775	5000	6675	44	500	1300	----
24	2700	4850	6500				

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TABLE VIII. Continuity.

AWG size	Maximum number of discontinuities		
	Type H	Type H2	Type H3
14-24	25	5	3
25-30	25	7	5
31-46	25	5	—
47-50	25	10	—
51-56	25	—	—

Part number: Magnet wire covered by this specification shall be defined by the following part numbering system. Example: M1177/12-02C029

M1177/12-	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
H	01	Copper	C
H2	02	Aluminum	A
H3	03	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 H magnet wire is intended for use in 180°C applications similar to those for which type T is used.

Revision letters are not used to denote changes due to the extensiveness of the changes.

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
(Project 6145-1111-09)

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