

INCH-POUND

J-W-1177/33

June 10, 1988

## FEDERAL SPECIFICATION SHEET

WIRE, MAGNET, ELECTRICAL, CLASS 180, TYPE GO,  
GLASS-FIBER-COVERED, ORGANIC VARNISH TREATED, RECTANGULAR

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 G20 (bare with double glass fiber covered, varnished),  
type L2G0 and type L2G20 (heavy film, single or double glass fiber covered, varnished);  
rectangular.
- Insulating materials: The fiber covering and application of the covering shall be as specified in J-W-1177. If an underlying film coating is used, it shall have a class 155 rating. The varnish used in treating fibrous covered wire shall conform to the requirements of class 180 of MIL-I-24092, or an alternate selected on the basis of equivalent test data. The varnish shall be a high temperature non-silicone insulating varnish. The varnish used shall be identified in the qualification test report.
- NEMA/ANSI equivalent: All test requirements are equivalent to MW-52 of NEMA MW 1000.
- General requirements: See J-W-1177 for general requirements, quality assurance provisions, and packaging.

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## Requirements:

Characteristics	Test procedure, see J-W-1177	Wire sizes, AWG	Requirements
Dimensions	4.7.1.2	All	<p>Rectangular wire:</p> <p>(a) Conductor dimensions and radii - see table I.</p> <p>(b) Conductor tolerances - see table II.</p> <p>(c) Increase in thickness - see table III (type L2G0), table IV (type G20) and table V (type L2G20).</p> <p>(d) Increase in width due to the glass fiber covering shall be equal to or less than the increase in thickness.</p> <p>Square wire:</p> <p>(a) Conductor dimensions, radii and tolerances - see table VI.</p> <p>(b) Increase in thickness and width - see table VI.</p>
Adherence and flexibility	4.7.2.3.1	All	For bare wire, not less than 75 volts/mil of minimum thickness of the glass fiber covering on one side.
	4.7.2.3.2	All	For film coated wire, no cracks visible in the film coating after 20 percent elongation. Examine with normal vision without removal of the glass fiber covering.
Elongation	4.7.5	All	Not less than 32 percent for thicknesses of 0.049 inch and greater, or 30 percent for thicknesses less than 0.049 inch.
Dielectric strength	4.7.9	All	Not less than 90 volts/mil of the minimum thickness of the glass fiber covering on one side (one-half the minimum specified under "Dimensions") plus the minimum breakdown for film coated wire.
Thermal endurance	----	All	Class 180. Insulating materials shall meet the thermal class ratings as described above.

TABLE I. Dimensions and radii for rectangular wire.

Nominal thickness	Nominal width																																				
	Inch	.079	1/.083	.088	1/.093	.098	1/.104	.110	1/.118	.124	1/.132	.140	1/.148	.157	1/.167	.177	1/.187	.197	1/.209	.220	1/.236	.248	1/.264	.280	1/.295	.315	1/.335	.354	1/.374	.394	1/.417	.441	1/.465	.492			
0.025																																					
.028																																					
.031																																					
.035																																					
.039																																					
.044																																					
.049																																					
.055																																					
.063																																					
.071																																					
.079										0.020																									0.031		
.088																																					
.098																																					
.110														0.025																							
.124																																					
.140																																					
.157																																					
.177																																					
.197																																					
.220																																					0.039

1/ R-40 series numbers.

EXAMPLE - Preferred sizes 55 x 110 (R20 x R20)

Radii tolerances are plus

Intermediate sizes 55 x 118 (R20 x R40)

or minus 25 percent.

TABLE II. Conductor tolerances.

Thickness, inch	Permissible variations in thickness
0.220 to 0.098	+ 1 percent
Under 0.098 to 0.025	+ 0.001 percent
Width, inch	
0.492 to 0.315	+ 0.003 inch
Under 0.315 to 0.098	+ 1 percent
Under 0.098 to 0.079	+ 0.001 inch

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TABLE III. Dimensions (type L2G0).

single glass fiber covering. Heavy film coating and high temperature organic varnish, rectangular wire		
Nominal thickness	Nominal width	Nominal thickness
Millimeters		Millimeters
Inches		Inches
0.63	0.079	0.025
.71	1/0.083	.026
.80	0.088	.031
.90	2.24	.035
1.00	2.37	.039
1.12	2.50	.044
1.25	2.65	.049
1.40	2.80	.055
1.60	2.98	.063
1.80	3.15	.071
2.00	3.35	.079
2.24	3.55	.088
2.50	3.75	.098
2.80	4.00	.110
3.15	4.25	.124
3.55	4.50	.140
4.00	4.75	.157
4.50	5.00	.177
5.00	5.30	.197
5.60	5.60	.220
	6.00	
	6.30	
	6.70	
	7.10	
	7.50	
	8.00	
	8.50	
	9.00	
	9.50	
	10.0	
	10.6	
	11.2	
	11.8	
	12.5	
	0.012 inch (0.305 mm)	
	0.013 inch (0.330 mm)	
	0.014 inch (0.356 mm)	
	0.015 inch (0.381 mm)	
	0.016 inch (0.406 mm)	

See footnote at top of next page.

1/ R-40 series intermediate number.

EXAMPLE - Preferred size      0.055 x 0.110 (R-20 x R-20)  
                  Intermediate size 0.055 x 0.118 (R-20 x R-40)

NOTES:

1. The maximum increase due to the glass fiber covering may be exceeded provided the overall dimension of the covered wire does not exceed the sum of the maximum thickness of the bare wire plus the maximum increase due to the heavy film coating and single glass fiber covering.
2. The increase in thickness due to the heavy film coating shall be for film coated wire.
3. The increase in thickness due to the single glass fiber covering shall be determined by subtracting 0.005 inch (0.127 mm) (maximum thickness of film coating) from the maximum increase in thickness given in the table.
4. The increase in width due to the glass fiber covering shall be equal to or less than the maximum increase in thickness given in the table. Note 1 applies to the increase in width as well as the increase in thickness.
5. Because it is impossible to accurately separate the glass fiber covering from the film coating, the total minimum increase in the thickness of the film-coated glass fiber covered rectangular wire shall be the sum of the minimum increase due to the film coating (as shown for film-coated wire) and the minimum increase due to the glass-fiber covering. The total minimum increase shall be not less than 70 percent of the maximum increase given in the table above, rounded to the nearest 0.001 inch (0.025 mm).
6. For direct conversion of inches to millimeters, multiply inches by the factor 25.4 (exact).

TABLE IV. Dimensions (type G20).

Nominal thickness		Nominal width																Nominal thickness																	
Maximum increase in thickness, inches (mm), due to double glass fiber covering and high temperature organic varnish, rectangular wire																																			
Millimeters	Inches	2.00	2.12	2.24	2.37	2.50	2.65	2.80	3.00	3.15	3.35	3.55	3.75	4.00	4.25	4.50	4.75	5.00	5.30	5.60	6.00	6.30	6.70	7.10	7.50	8.00	8.50	9.00	9.50	10.0	10.6	11.2	11.8	12.5	
Millimeters	Inches	0.079	1/0.083	0.088	1/0.093	0.098	1/0.104	0.110	1/0.118	0.124	1/0.132	0.140	1/0.148	0.157	1/0.167	0.177	1/0.187	0.197	1/0.209	0.220	1/0.236	0.248	1/0.264	0.280	1/0.295	0.315	1/0.335	0.354	1/0.374	0.394	1/0.417	0.441	1/0.465	0.492	12.5
0.63	0.025	0.012 inch (0.305 mm)																0.025		0.63															
.71	.028																	0.025			0.013 inch (0.330 mm)	0.028		0.71											
.80	.031																	0.031				0.014 inch (0.356 mm)	0.031		.80										
.90	.035																	0.035					0.015 inch (0.381 mm)			0.035		.90							
1.00	.039	0.039		0.016 inch (0.406 mm)	0.039		1.00																												
1.12	.044	0.044			0.018 inch (0.457 mm)	0.044		1.12																											
1.25	.049	0.049				0.019 inch (0.483 mm)			0.049		1.25																								
1.40	.055	0.055							0.019 inch (0.483 mm)	0.055		1.40																							
1.60	.063	0.063		0.019 inch (0.483 mm)			0.063			1.60																									
1.80	.071	0.071			0.019 inch (0.483 mm)		0.071						1.80																						
2.00	.079	0.079				0.019 inch (0.483 mm)	0.079				2.00																								
2.24	.088	0.088					0.019 inch (0.483 mm)	0.088				2.24																							
2.50	.098	0.098		0.019 inch (0.483 mm)				0.098		2.50																									
2.80	.110	0.110			0.019 inch (0.483 mm)			0.110					2.80																						
3.15	.124	0.124				0.019 inch (0.483 mm)		0.124			3.15																								
3.55	.140	0.140					0.019 inch (0.483 mm)	0.140				3.55																							
4.00	.157	0.157		0.019 inch (0.483 mm)				0.157		4.00																									
4.50	.177	0.177			0.019 inch (0.483 mm)			0.177					4.50																						
5.00	.197	0.197				0.019 inch (0.483 mm)		0.197			5.00																								
5.60	.220	0.220					0.019 inch (0.483 mm)	0.220				5.60																							

See footnote at top of next page.

1/ R-40 series intermediate number.

EXAMPLE - Preferred size      0.055 x 0.110 (R-20 x R-20)  
Intermediate size    0.055 x 0.118 (R-20 x R-40)

NOTES:

1. The maximum increase due to the glass fiber covering may be exceeded provided the overall dimension of the covered wire does not exceed the sum of the maximum thickness of the bare wire plus the maximum increase due to the glass fiber covering.
2. The minimum increase due to the glass fiber covering shall be not less than 70 percent of the maximum shown in the table above, rounded to the nearest 0.001 inch (0.025 mm).
3. The increase in width due to the glass fiber covering shall be equal to or less than the maximum increase in thickness given in the table. Note 1 applies to the increase in width as well as the increase in thickness.
4. For direct conversion of inches to millimeters, multiply inches by the factor 25.4 (exact).





1/ R-40 series intermediate number.

EXAMPLE - Preferred size      0.055 x 0.110 (R-20 x R-20)  
                  Intermediate size    0.055 x 0.118 (R-20 x R-40)

NOTES:

1. The maximum increase due to the glass fiber covering may be exceeded provided the overall dimension of the covered wire does not exceed the sum of the maximum thickness of the bare wire plus the maximum increase given in table 1.
2. The increase in thickness due to the heavy film coating shall be for film coated wire.
3. The minimum increase due to the glass fiber covering shall be not less than 70 percent of the maximum shown in table IV, rounded to the nearest 0.001 inch (0.025 mm).
4. The increase in width due to the glass fiber covering shall be equal to or less than the maximum increase in thickness given in table IV. Note 1 applies to the increase in width as well as the increase in thickness.
5. Because it is impossible to accurately separate the glass fiber covering from the film coating, the total minimum increase in the thickness of a film coated glass fiber covered rectangular wire shall be the sum of the maximum increase due to the film coating (as shown for film coated wire) and the minimum increase due to the glass fiber covering. The total minimum increase shall be not less than 70 percent of the maximum increase given in table IV, plus the minimum for the film coated wire, rounded to the nearest 0.001 inch (0.025 mm).
6. For direct conversion of inches to millimeters, multiply inches by the factor 25.4 (exact).

TABLE VI. Dimensions, square wire.

Minimum increase and maximum overall dimensions, inches (mm), due to single glass fiber covering, heavy film coating and high temperature organic varnish, square wire

Square AWG size	Bare wire dimension						Nominal radii,		Insulation				Square AWG size
	Minimum		Nominal		Maximum				Minimum increase in dimension,		Maximum overall dimension,		
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm			
0	0.3219	8.176	0.3249	8.252	0.3279	8.329	0.040	1.02	0.011	0.279	0.344	8.738	0
1	.2864	7.275	.2893	7.348	.2922	7.422	.040	1.02	.010	.254	.307	7.798	1
2	.2550	6.477	.2576	6.543	.2602	6.609	.040	1.02	.010	.254	.275	6.985	2
3	.2271	5.768	.2294	5.827	.2317	5.885	.040	1.02	.010	.254	.247	6.274	3
4	.2023	5.138	.2043	5.189	.2063	5.240	.040	1.02	.010	.254	.221	5.613	4
5	.1801	4.575	.1819	4.620	.1837	4.666	.040	1.02	.009	.229	.198	5.029	5
6	.1604	4.074	.1620	4.115	.1636	4.155	.032	0.81	.009	.229	.178	4.521	6
7	.1429	3.630	.1443	3.665	.1457	3.701	.032	.81	.009	.229	.159	4.039	7
8	.1272	3.231	.1285	3.264	.1298	3.297	.032	.81	.009	.229	.143	3.632	8
9	.1133	2.878	.1144	2.906	.1155	2.934	.026	.66	.009	.229	.129	3.277	9
10	.1009	2.563	.1019	2.588	.1029	2.614	.026	.66	.009	.229	.116	2.946	10
11	.0897	2.278	.0907	2.304	.0917	2.329	.020	.51	.008	.203	.104	2.642	11
12	.0798	2.027	.0808	2.052	.0818	2.078	.020	.51	.008	.203	.094	2.388	12
13	.0710	1.803	.0720	1.829	.0730	1.854	.016	.41	.008	.203	.085	2.159	13
14	.0631	1.603	.0641	1.628	.0651	1.654	.016	.41	.008	.203	.077	1.956	14

NOTES:

1. Radii tolerance is plus or minus 25 percent.
2. For direct conversion of inches to millimeters, multiply inches by the factor 25.4 (exact).

TABLE VI. Dimensions, square wire. - Continued

## Type C20 and L2C20

Minimum increase and maximum overall dimensions, inches (mm), due to double glass fiber covering and high temperature organic varnish, square wire

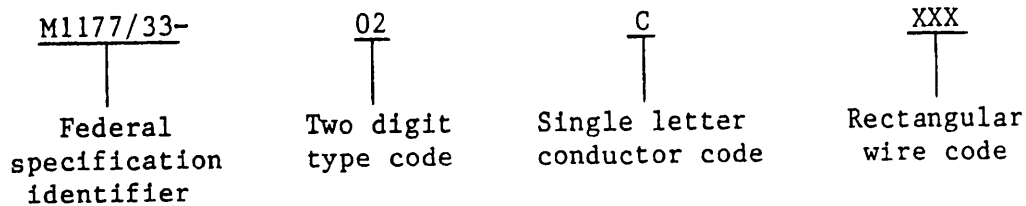
Square AWG size	Bare wire dimension						Nominal radii,		Bare double-glass-covered wire				Heavy-film-coated double-glass-covered wire			
	Minimum		Nominal		Maximum				Minimum increase in dimension,		Maximum overall dimension,		Minimum increase in dimension,		Maximum overall dimension,	
	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm
0	0.3219	8.176	0.3249	8.252	0.3279	8.329	0.040	1.02	0.013	0.330	0.340	8.788	0.010	0.406	0.351	8.915
1	.2864	7.275	.2893	7.348	.2922	7.422	.040	1.02	.012	.305	.309	7.849	.015	.381	.314	7.976
2	.2550	6.477	.2576	6.543	.2602	6.609	.040	1.02	.012	.305	.277	7.036	.015	.381	.282	7.163
3	.2271	5.768	.2294	5.827	.2317	5.885	.040	1.02	.011	.279	.248	6.299	.014	.350	.253	6.426
4	.2023	5.138	.2043	5.189	.2063	5.240	.040	1.02	.011	.279	.222	5.639	.014	.350	.227	5.760
5	.1801	4.575	.1819	4.620	.1837	4.666	.040	1.02	.011	.279	.190	5.055	.014	.350	.204	5.182
6	.1604	4.074	.1620	4.115	.1636	4.155	.032	0.81	.011	.279	.179	4.547	.014	.350	.184	4.674
7	.1429	3.630	.1443	3.665	.1457	3.701	.032	.81	.010	.254	.160	4.064	.013	.330	.165	4.191
8	.1272	3.231	.1285	3.264	.1298	3.297	.032	.81	.010	.254	.144	3.658	.013	.330	.149	3.785
9	.1133	2.878	.1144	2.906	.1155	2.934	.026	.66	.009	.299	.129	3.277	.012	.305	.134	3.404
10	.1009	2.563	.1019	2.588	.1029	2.614	.026	.66	.009	.229	.116	2.946	.012	.305	.121	3.073
11	.0897	2.278	.0907	2.304	.0917	2.329	.020	.51	.008	.203	.104	2.642	.011	.279	.109	2.709
12	.0798	2.027	.0808	2.052	.0818	2.078	.020	.51	.008	.203	.094	2.388	.011	.279	.099	2.515
13	.0710	1.803	.0720	1.829	.0730	1.854	.016	.41	.008	.203	.085	2.159	.011	.279	.090	2.280
14	.0631	1.603	.0641	1.628	.0651	1.654	.016	.41	.008	.203	.077	1.956	.011	.279	.082	2.083

## NOTES:

1. Radii tolerance is plus or minus 25 percent.
2. For direct conversion of inches to millimeters, multiply inches by the factor 25.4 (exact).

J-W-1177/33

Part number: Magnet wire covered by this specification shall be defined by the following part numbering system. Example: M1177/33-02CXXX.



The following codes shall apply:

Type	Type code	Conductor	Conductor code
G20	01	Copper	C
L2G0	02	Aluminum	A
L2G20	03	Nickel-coated copper	N
		Silver-coated copper	S

Intended use: Type G0 rectangular magnet wire is intended for use in 180°C applications similar to those for which type G0 round magnet wire is used.

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 - DCC  
NASA - JFK  
COMMERCE - NBS  
TRANSPORTATION - APM, FAA

Preparing activity:

Navy - SH  
(Project 6145-1111-29)