MWS®
Wire Industries

World's Largest Selection of Specialty and Magnet Wire

Company Profile

Responsive Solutions

Since 1968 MWS Wire Industries has operated under the simple premise that total customer satisfaction is the key to our long-term success and growth. Our primary objective is to exceed our customers' expectations of product quality and service.

Whether it's same-day delivery from our inventory of 50,000 unique wire items or producing a wire to meet a customer's just-in-time production schedule, our highly trained staff of wire professionals is committed to meeting the needs of wire users worldwide on time, every time.

From new product development – where we build special wires to improve the overall performance of electronic components – to R&D production of wire for new and innovative applications, MWS has the resources to give you a competitive edge.

MWS Wire Industries,, founded in 1968 and located in Westlake Village, California since 1981, keeps in inventory the largest variety of magnet wire and specialty wire made to commercial, military, and customer specifications. This facility houses drawing, shaping, rolling, twisting, and film coating equipment for production of wire for high technology users worldwide.

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Magnet Wire Insulation Guide

THERMAL CLASS	INSULATION TYPE	MWS PRODUCT CODE	NEMA STANDARD (MW1000)	IEC STANDARD (60317)	FEDERAL SPECIFICATION (JW 1177)
105°C	Plain Enamel	PE	**NONE**	NONE	NONE
	Formvar*	F	**MW 15 (RD) MW 18 (SQ & RECT)**	60317-1(RD) 60317-17(SQ & RECT)	JW 1177/ 14 (RD) JW1177/ 16 (SQ & REC
	Formvar Bondable	FB	**MW 19**	60317-5	JW 1177/ 6
130°C	Polyurethane Nylon Bondable - 130	PE	**NONE**	NONE	NONE
155°C	Polyurethane - 155*	P155	**MW 79**	60317-20	JW 1177/ 41
	Polyurethane Nylon - 155*	PN155	**MW 80**	60317-21	JW 1177/ 42
	Polyurethane Bondable - 155*	PB155	**MW 131**	60317-35	NONE
	Polyurethane Nylon Bondable - 155	PNB155	**MW 136**	NONE	NONE
	Dacron Glass - 155	DGLAS 155	**MW 45 (RD) MW 46 (SQ & RECT)**	NONE(RD) 60317-60(SQ & RECT)	JW 1177/ 20 (RD) JW1177/ 25 (SQ & REC
180°C	Polyurethane - 180*	P180	**MW 82**	60317-51	NONE
	Polyurethane Nylon - 180*	PN180	**MW 83**	60317-55	NONE
	Polyester-imide*	PT	**MW 30**	60317-8	JW 1177/ 12
	Polyester-Nylon*	PTN	**MW 76**	60317-22	JW 1177/ 38
	Solderable Polyester*	SPT	**MW 77**	60317-23	JW 1177/ 39
	Solderable Polyester Nylon*	SPTN	**MW 78**	NONE	JW 1177/ 40
	Polyurethane Bondable - 180	PB180	**MW 132**	NONE	NONE
	Polyurethane Nylon Bondable - 180	PNB180	**MW 137**	NONE	NONE
	Polyester-imide Bondable	PTB	**NONE**	60317-37	NONE
	Polyester-amide-imide Bondable*	APTB	**MW 102**	60317-38	NONE
	Solderable Polyester Bondable	SPTB	**NONE**	60317-36	NONE
	Dacron Glass High Temp	DGLAS HT	**MW 51 (RD) MW 53 (SQ & RECT)**	NONE(RD) 60317-61(SQ & RECT)	JW 1177/ 32 (RD) JW1177/ 34 (SQ & RECT
200°C	Polyester - 200*	PT200	**MW 74**	60317-42	JW 1177/43
	Polyester A/I Topcoat*	APT	**MW 35 (RD) MW 36 (SQ & RECT)**	60317-13(RD) 60317-29(SQ & RECT)	JW 1177/ 14 (RD) JW1177/ 13 (SQ & REC
	Polyester A/I Polyamideimide*	APTIG	**MW 73**	60317-13	NONE
240°C	Polyimide - ML*	ML**	**MW 16 (RD) MW 20 (SQ & RECT)**	60317-46(RD) 60317-47(SQ & RECT)	JW 1177/ 15 (RD) JW1177/ 18 (SQ & RECT

* UL Recognized Insulations

** Registered trademark of IST Industrial Summit Technology

INSULATION CHARACTERISTICS	GENERAL APPLICATIONS
Plain Enamel was one of the earliest film insulations developed for automotive ignition coils. Today it is primarily used in musical instruments for pickup coils. It is manufactured to single build dimensions and stocked in sizes 41 to 43 AWG.	Pickup coils for guitars and other instruments
Formvar was an early synthetic insulation composed of modified polyvinyl resins designed for continuous operation at 105C. It has excellent abrasion resistance and is compatible with most varnishes and impregnating compounds.	Oil filled transformers, motors, solenoids, superconducting coils or other cryogenic applications
Formvar with a superimposed thermoplastic film for use in heat or solvent activated self-bonding coils.	Relays, yoke coils, self-supporting coils
Class 130˚C solderable polyurethane with superimposed thermoplastic polyvinyl butyral film for heat or solvent activated self-bonding coils with excellent bond strength at room temperature.	Voice coils, yoke coils, self-supporting coils
Solderable film composed of modified polyurethane resins designed mostly for fine wire applications with excellent resistance to moisture and most solvents.	Relays, high frequency coils and transformers, solenoids, small motors
Solderable dual film composed of modified polyurethane resins with a polyamide (nylon) overcoat that provides improvement in severe winding operations.	Appliance motors, relays, torroidal coils, fractional HP motors
Solderable polyurethane or polyurethane with nylon overcoat and a superimposed thermoplastic butyral film for coils requiring Class F service. Coils may be bonded by heat or with denatured alcohol. Generally made as Type 1 insulation build equal to heavy overall diameter.	Voice coils, helical coils, inductors, self-supporting coils
Dacron Glass is a combination of glass and polyester fibers applied as a served filament over bare or film coated magnet wire and may be supplied with an epoxy varnish or as fused unvarnished to prevent fraying of the fibers.	Dry transformers, Class B motors
Polyurethane film designed for applications requiring high thermal resistance and low soldering temperature.	Relays, ignition coils, solenoids, small transformers
Polyurethane with polyamide (nylon) overcoat for applications requiring high thermal properties and chemical resistance. Soldering temperatures 430˚C (14-23 AWG) or 390˚C (24 AWG and finer).	Relays, pulse transformers, small appliance motors
Film insulation composed of modified polyester resins with excellent chemical resistance.	Solenoids, servo motors, small appliance motors
Dual film composed of modified polyester resins with a nylon overcoat. Combines continuous 180˚C operating temperature and low coefficient of friction for superior winding and insertion properties.	Motor stators, fractional HP motors
Film insulation composed of modified polyesterimide resins designed to solder at 470˚C, generally made at 24 AWG and finer sizes.	High temperature relays, transformers, automotive coils
Dual film composed of modified polyesterimide resins with nylon overcoat for superior performance where winding stresses may be severe. Designed to solder at 470˚C, this insulation is made mostly in heavier gauge sizes.	Transformers, automotive coils, appliance motors
One part (Polyurethane) or dual (Polyurethane Nylon) insulation system with superimposed thermoplastic film combining high thermal resistance, solderability, and self-bonding features.	Self-supporting coils, relays, voice coils
These are wires that combine characteristics of various class 180˚C film insulations with self-bonding feature. Bonding method depends on choice of bond coat. May be made as Type 1 (heavy diameter) or Type 2 (triple diameter) construction.	Voice coils, inductors, yoke coils, small motors
Like Dacron Glass 155 except treated with high temperature organic varnish. May be served over bare or film coated magnet wire. Available only in shaped or heavy round wire sizes.	Large generators and alternators, dry type transformers
One part film system composed of THEIC modified polyester resins capable of continuous 200˚C operating temperature designed specifically for finer size wires.	Coils, relays, small transformers, small appliance motors
A dual film insulation of polyester-amide-imide with polyamideimide (A/I) overcoat for superior windability, heat shock resistance, solvent resistance, and overload protection.	General purpose motors, fractional and integral motors (hermetic and open), dry type transformers
A triple film system composed of THEIC modified polyester, a corona resistant shield coat, and polyamideimide (A/I) overcoat designed to withstand severe voltage stresses. Made as heavy build construction in round sizes 12 through 24 AWG.	Inverter duty motors, high voltage motors
Film composed of aromatic polyimide resin that features high cut through, exceptional chemical resistance, minimal outgassing and capable of continuous operation at 240˚C in extremely harsh environments.	High temperature continuous duty coils, hermetically sealed relays, fractional and integral HP motors

Copper Magnet Wire Data

SIZE (AWG)	BARE COPPER									SIZE (AWG)
	DIAMETER * (INCHES)			RESISTANCE** (OHMS PER 1000 FT. AT 20°C)			FEET PER POUND	POUNDS PER 1000 FT.	CIRCULAR MILS NOMINAL	
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.				
6	.1604	.1620	.1633	.3875	.3952	.4031	12.59	79.44	26240	6
7	.1429	.1443	.1454	.4885	.4981	.5079	15.87	63.03	20820	7
8	.1272	.1285	.1294	.6156	.6281	.6410	20.01	49.98	16510	8
9	.1133	.1144	.1153	.7774	.7924	.8079	25.24	39.62	13090	9
10	.1009	.1019	.1027	.9795	.9988	1.019	31.82	31.43	10380	10
11	.0898	.0907	.0916	1.236	1.261	1.286	40.2	24.9	8226	11
12	.0800	.0808	.0816	1.558	1.589	1.620	50.6	19.8	6529	12
13	.0713	.0720	.0727	1.962	2.001	2.040	63.7	15.7	5184	13
14	.0635	.0641	.0647	2.477	2.524	2.572	80.4	12.4	4109	14
15	.0565	.0571	.0577	3.115	3.181	3.249	101	9.87	3260	15
16	.0503	.0508	.0513	3.941	4.019	4.099	128	7.81	2581	16
17	.0448	.0453	.0458	4.944	5.054	5.167	161	6.21	2052	17
18	.0399	.0403	.0407	6.261	6.386	6.514	203	4.92	1624	18
19	.0355	.0359	.0363	7.871	8.047	8.229	256	3.90	1289	19
20	.0317	.0320	.0323	9.941	10.13	10.32	323	3.10	1024	20
21	.0282	.0285	.0288	12.50	12.77	13.04	407	2.46	812.3	21
22	.0250	.0253	.0256	15.82	16.20	16.59	516	1.94	640.1	22
23	.0224	.0226	.0228	19.95	20.31	20.67	647	1.55	510.8	23
24	.0199	.0201	.0203	25.17	25.67	26.19	818	1.22	404.0	24
25	.0177	.0179	.0181	31.66	32.37	33.10	1030	.970	320.4	25
26	.0157	.0159	.0161	40.01	41.02	42.07	1310	.765	252.8	26
27	.0141	.0142	.0143	50.72	51.43	52.17	1640	.610	201.6	27
28	.0125	.0126	.0127	64.30	65.33	66.37	2080	.481	158.8	28
29	.0112	.0113	.0114	79.80	81.22	82.68	2590	.387	127.7	29
30	.0099	.0100	.0101	101.7	103.7	105.8	3300	.303	100.0	30
31	.0088	.0089	.0090	128.0	130.9	133.9	4170	.240	79.21	31
32	.0079	.0080	.0081	158.1	162.0	166.2	5160	.194	64.00	32
33	.0070	.0071	.0072	200.1	205.7	211.7	6550	.153	50.41	33
34	.0062	.0063	.0064	253.2	261.3	269.8	8320	.120	39.69	34
35	.0055	.0056	.0057	319.2	330.7	342.8	10500	.0949	31.36	35
36	.0049	.0050	.0051	398.7	414.8	431.9	13200	.0757	25.00	36
37	.0044	.0045	.0046	490.1	512.1	535.7	16300	.0613	20.25	37
38	.0039	.0040	.0041	617.0	648.2	681.9	20600	.0484	16.00	38
39	.0034	.0035	.0036	800.2	846.6	897.1	27000	.0371	12.25	39
40	.0030	.0031	.0032	1013	1079	1152	34400	.0291	9.61	40
41	.0027	.0028	.0029	1233	1323	1423	42100	.0237	7.84	41
42	.0024	.0025	.0026	1534	1659	1801	52900	.0189	6.25	42
43	.0021	.0022	.0023	1960	2143	2352	68300	.0147	4.84	43
44	.0019	.0020	.0021	2352	2593	2873	82600	.0121	4.00	44
45	.00169	.00176	.00183	3080	3348	3616	106,500	.00939	3.10	45
46	.00151	.00157	.00164	3870	4207	4544	134,400	.00744	2.47	46
47	.00135	.00140	.00146	4868	5291	5714	169,200	.00591	1.96	47
48	.00119	.00124	.00129	6205	6745	7285	213,400	.00469	1.54	48
49	.00107	.00111	.00116	7744	8417	9090	269,700	.00371	1.23	49
50	.00095	.00099	.00103	9734	10580	11430	339,700	.00294	.98	50
51	.00085	.00088	.00092	12320	13390	14460	428,400	.00233	.775	51
52	.00075	.00078	.00081	15690	17050	18410	540,000	.00185	.608	52
53	.00067	.00070	.00073	19480	21170	22860	681,200	.00147	.490	53
54	.00060	.00062	.00065	24820	26980	29140	859,100	.00116	.384	54
55	.00053	.00055	.00057	31540	34280	37020	1,083,000	.000923	.303	55

* Minimum and maximum dimensions are based on tolerances specified by ASTM Standard B3 and NEMA MW1000-2015 for sizes 6 - 44 AWG. Sizes 45 - 55 AWG dimensions calculated from DC resistance.
** Values are based on a resistivity of 10.371 ohms per circular mil/ft at 20°C. (100% IACS conductivity). Minimum resistance values are based on maximum bare diameter. Maximum resistance values are based on minimum bare diameter.
6 - 44 AWG magnet wire will be furnished to dimensional standard with resistance values as a guideline.
45 - 55 AWG magnet wire will be furnished to resistance with the dimensions as a guideline.

Dimensional values derived from NEMA MW1000-2015 Standard

SIZE (AWG)	SINGLE BUILD				HEAVY BUILD				TRIPLE BUILD				**QUADRUPLE BUILD				SIZE (AWG)
	DIAMETER * (INCHES)			FEET PER POUND	DIAMETER * (INCHES)			FEET PER POUND	DIAMETER * (INCHES)			FEET PER POUND	DIAMETER * (INCHES)			FEET PER POUND	
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		
6	.1622	.1648	.1665	12.545	.1640	.1656	.1672	12.5	.1651	.1679	.1688	12.455	.1663	.1685	.1706	12.41	6
7	.1446	.1469	.1485	15.81	.1464	.1478	.1492	15.75	.1475	.1492	.1508	15.69	.1488	.1506	.1525	15.63	7
8	.1289	.1302	.1314	19.93	.1307	.1320	.1332	19.85	.1317	.1333	.1348	19.77	.1330	.1349	.1365	19.69	8
9	.1150	.1162	.1173	25.12	.1167	.1179	.1190	25	.1177	.1191	.1205	24.88	.1190	.1205	.1221	24.76	9
10	.1026	.1037	.1047	31.66	.1043	.1054	.1064	31.5	.1052	.1064	.1076	31.34	.1077	.1088	.1098	31.18	10
11	.0915	.0925	.0936	39.6	.0931	.0942	.0952	39	.0940	.0952	.0963	38.4	.0964	.0974	.0983	38.34	11
12	.0816	.0825	.0835	50.25	.0832	.0842	.0851	49.9	.0840	.0851	.0861	49.55	.0864	.0873	.0881	49.2	12
13	.0729	.0737	.0746	63.3	.0745	.0754	.0762	62.9	.0752	.0762	.0771	62.5	.0777	.0785	.0793	62.1	13
14	.0651	.0659	.0666	79.94	.0667	.0675	.0682	79.18	.0683	.0691	.0698	78.42	.0699	.0707	.0714	77.66	14
15	.0580	.0587	.0594	100.4	.0595	.0603	.0610	99.7	.0611	.0618	.0625	99	.0626	.0633	.0640	98.3	15
16	.0517	.0524	.0531	126.8	.0532	.0539	.0545	125.6	.0546	.0553	.0560	124.4	.0561	.0568	.0574	123.2	16
17	.0462	.0469	.0475	159.4	.0476	.0482	.0488	157.7	.0489	.0496	.0502	156	.0503	.0510	.0516	154.3	17
18	.0412	.0418	.0424	201.1	.0425	.0431	.0437	199.2	.0438	.0444	.0450	197.3	.0451	.0458	.0464	195.4	18
19	.0367	.0373	.0379	253.2	.0380	.0386	.0391	250.6	.0392	.0398	.0404	248	.0405	.0412	.0418	245.4	19
20	.0329	.0335	.0340	318.4	.0341	.0346	.0351	314.5	.0352	.0358	.0363	310.6	.0364	.0371	.0377	306.7	20
21	.0293	.0298	.0303	400.6	.0304	.0310	.0315	395.3	.0316	.0321	.0326	390	.0327	.0333	.0340	384.7	21
22	.0261	.0266	.0270	507.1	.0271	.0276	.0281	502.5	.0282	.0287	.0292	497.9	.0293	.0300	.0306	493.3	22
23	.0234	.0239	.0243	633.7	.0244	.0249	.0253	625	.0254	.0259	.0263	616.3	.0264	.0271	.0277	607.6	23
24	.0209	.0213	.0217	804.5	.0218	.0223	.0227	790.5	.0228	.0232	.0236	776.5	.0237	.0244	.0250	762.5	24
25	.0186	.0190	.0194	1010	.0195	.0199	.0203	992.1	.0204	.0208	.0212	974.2	.0213	.0220	.0226	956.3	25
26	.0166	.0170	.0173	1279	.0174	.0178	.0182	1254	.0183	.0187	.0191	1229	.0192	.0198	.0204	1204	26
27	.0149	.0153	.0156	1600	.0157	.0161	.0165	1571	.0166	.0170	.0173	1542	.0174	.0180	.0185	1513	27
28	.0133	.0137	.0140	2028	.0141	.0144	.0147	1987	.0148	.0152	.0155	1946	.0156	.0162	.0167	1905	28
29	.0119	.0123	.0126	2513	.0127	.0130	.0133	2463	.0134	.0138	.0141	2413	.0142	.0147	.0151	2363	29
30	.0106	.0109	.0112	3208	.0112	.0117	.0121	3136	.0119	.0123	.0126	3064	.0125	.0132	.0138	2992	30
31	.0094	.0097	.0100	4052	.0100	.0104	.0108	3948	.0106	.0110	.0114	3844	.0112	.0119	.0125	3740	31
32	.0085	.0088	.0090	4995	.0090	.0094	.0097	4873	.0096	.0099	.0102	4751	.0101	.0107	.0112	4629	32
33	.0075	.0078	.0081	6337	.0080	.0084	.0087	6161	.0085	.0089	.0092	5985	.0090	.0096	.0101	5809	33
34	.0067	.0070	.0072	8055	.0071	.0075	.0078	7837	.0076	.0080	.0083	7619	.0081	.0086	.0091	7401	34
35	.0059	.0062	.0065	10250	.0064	.0067	.0070	9891	.0068	.0072	.0075	9532	.0072	.0077	.0082	9173	35
36	.0053	.0056	.0058	12800	.0057	.0060	.0063	12380	.0061	.0064	.0067	11960	.0065	.0070	.0074	11540	36
37	.0048	.0050	.0052	15750	.0051	.0055	.0057	15290	.0055	.0058	.0061	14830	.0058	.0063	.0067	14370	37
38	.0042	.0045	.0047	20020	.0046	.0049	.0051	19360	.0049	.0052	.0055	18700	.0052	.0056	.0060	18040	38
39	.0037	.0040	.0042	26240	.0040	.0043	.0045	25270	.0043	.0046	.0049	24300	.0046	.0050	.0054	23330	39
40	.0033	.0035	.0037	33330	.0035	.0038	.0041	31940	.0038	.0041	.0044	30550	.0041	.0045	.0049	29160	40
41	.0030	.0032	.0033	40800	.0032	.0035	.0037	39340	.0035	.0038	.0040	37880	.0037	.0041	.0044	36420	41
42	.0026	.0028	.0030	50940	.0029	.0031	.0033	49600	.0031	.0034	.0036	48260	.0033	.0036	.0039	46920	42
43	.0023	.0025	.0027	66140	.0025	.0027	.0029	63170	.0027	.0029	.0032	60200	.0029	.0033	.0036	57230	43
44	.0021	.0023	.0024	80060	.0023	.0025	.0026	76160	.0025	.0027	.0029	72260	.0027	.0030	.0032	68360	44
45	.00189	.00205	.00220	103,500	.00209	.00225	.00240	99110	.00219	.00245	.00270	94720	.00239	.00260	.00290	90330	45
46	.00171	.00173	.00200	130,000	.00181	.00196	.00210	123,800	.00201	.00221	.00240	117,600	.00221	.00241	.00260	111,400	46
47	.00145	.00158	.00170	163,400	.00165	.00178	.00190	154,600	.00185	.00198	.00210	145,800	.00205	.00218	.00230	137,000	47
48	.00129	.00140	.00150	204,900	.00139	.00155	.00170	196,900	.00159	.00175	.00190	188,900	.00169	.00190	.00210	180,900	48
49	.00117	.00124	.00130	259,700	.00127	.00139	.00150	247,500	.00147	.00159	.00170	235,300	.00157	.00174	.00190	223,100	49
50	.00105	.00113	.00120	324,700	.00115	.00128	.00140	307,700	.00125	.00143	.00160	290,700	.00135	.00158	.00180	273,700	50
51	.00095	.00103	.00110	406,500	.00105	.00117	.00129	383,100	.00115	.00133	.00150	359,700	.00125	.00148	.00170	336,300	51
52	.00085	.00093	.00100	507,600	.00095	.00107	.00105	476,200	.00105	.00123	.00140	444,800	.00115	.00138	.00160	413,400	52
53	.00072	.00079	.00085	653,600	.00080	.00090	.00103	621,100	.00087	.00104	.00121	588,600	.00097	.00118	.00139	556,100	53
54	.00065	.00070	.00075	826,400	.00073	.00082	.00095	775,200	—	—	—	—	—	—	—	—	54
55	.00058	.00064	.00070	1,032,000	.00066	.00075	.00087	961,500	—	—	—	—	—	—	—	—	55

* Diameters shown are per NEMA MW1000-2015. For Diameters per NEMA MW1000-1997 see page 33 or visit our website at www.mwswire.com

** Diameters shown do not include those for Quad Build NEMA MW1000-2015 MW16C.

Blue text above indicates changes from NEMA MW1000-1997 and page 33.

Red text above indicates sizes not covered by NEMA MW1000-2015. Values derived from MWS Wire Industries internal standards.

Half-Size Copper Magnet Wire

Dimensional values derived from NEMA MW1000-2015 Standard

SIZE (AWG)	BARE COPPER									SINGLE BUILD DIAMETER (INCHES)			HEAVY BUILD DIAMETER (INCHES)		
	DIAMETER (INCHES)			RESISTANCE (OHMS PER 1000 FT. AT 20°C)			FEET PER POUND	POUNDS PER 1000 FT.	CIRCULAR MILS						
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.			NOMINAL	MIN.	NOM.*	MAX.	MIN.	NOM.*	MAX.
4½	.1909	.1928	.1942	.2753	.2790	.2846	8.86	112.9	37290	——	——	——	.1946	.1964	.1982
5½	.1700	.1717	.1730	.3469	.3518	.3589	11.17	89.55	29580	——	——	——	.1736	.1753	.1769
6½	.1514	.1529	.1540	.4373	.4436	.4524	14.08	71.04	23470	——	——	——	.1550	.1565	.1579
7½	.1348	.1362	.1372	.5510	.5591	.5707	17.76	56.31	18600	——	——	——	.1383	.1397	.1410
8½	.1201	.1213	.1221	.6956	.7049	.7190	22.38	44.68	14760	.1218	.1230	.1241	.1235	.1247	.1258
9½	.1069	.1080	.1088	.8745	.8891	.9075	28.22	35.44	11710	.1086	.1098	.1108	.1103	.1114	.1125
10½	.0952	.0962	.0971	1.10	1.12	1.14	35.6	28.1	9270	.0969	.0980	.0991	.0985	.0996	.1007
11½	.0847	.0856	.0864	1.39	1.41	1.44	44.9	22.3	7360	.0863	.0873	.0883	.0880	.0890	.0900
12½	.0755	.0763	.0770	1.75	1.78	1.81	56.6	17.7	5840	.0771	.0780	.0789	.0787	.0796	.0805
13½	.0672	.0679	.0685	2.22	2.24	2.29	71.4	14.0	4620	.0688	.0696	.0704	.0704	.0712	.0720
14½	.0599	.0605	.0611	2.77	2.82	2.88	90.0	11.1	3670	.0615	.0622	.0629	.0630	.0638	.0645
15½	.0534	.0539	.0544	3.49	3.56	3.64	113	8.83	2920	.0549	.0556	.0563	.0564	.0571	.0578
16½	.0475	.0480	.0485	4.41	4.48	4.58	143	7.00	2310	.0489	.0496	.0502	.0503	.0510	.0516
17½	.0423	.0427	.0431	5.56	5.66	5.77	180	5.55	1830	.0436	.0443	.0449	.0450	.0456	.0462
18½	.0376	.0380	.0384	7.00	7.14	7.30	228	4.39	1450	.0389	.0395	.0400	.0401	.0407	.0413
19½	.0336	.0339	.0342	8.81	8.97	9.19	286	3.50	1160	.0348	.0354	.0359	.0360	.0366	.0371
20½	.0299	.0302	.0305	11.1	11.4	11.6	362	2.76	912	.0310	.0316	.0321	.0322	.0327	.0332
21½	.0266	.0269	.0272	14.0	14.3	14.5	457	2.19	724	.0277	.0282	.0287	.0288	.0293	.0298
22½	.0237	.0239	.0241	17.7	18.0	18.5	573	1.74	576	.0247	.0252	.0257	.0258	.0263	.0267
23½	.0211	.0213	.0215	22.2	22.6	23.3	721	1.39	458	.0221	.0226	.0230	.0231	.0236	.0240
24½	.0188	.0190	.0192	28.1	28.7	29.3	915	1.09	361	.0197	.0202	.0206	.0207	.0211	.0215
25½	.0167	.0169	.0171	35.5	36.3	37.2	1160	.865	286	.0176	.0180	.0184	.0185	.0189	.0193
26½	.0149	.0150	.0152	44.3	45.5	46.7	1450	.690	228	.0157	.0161	.0165	.0166	.0170	.0173
27½	.0133	.0134	.0135	56.1	57.7	58.6	1840	.543	180	.0141	.0145	.0148	.0149	.0153	.0156
28½	.0118	.0119	.0120	70.8	73.2	74.5	2290	.436	144	.0126	.0129	.0132	.0133	.0137	.0140
29½	.0105	.0106	.0107	90.6	92.3	94.0	2940	.340	112	.0112	.0115	.0118	.0119	.0123	.0126

* Nominal dimensional values calculated as the midpoint between minimum and maximum values. NEMA MW1000-2015 does not list “nominal” insulated values.

Sizes finer than 29½ AWG available upon request. For technical data on half-sizes finer than 29½ AWG see page 34.

Diameters shown are per NEMA MW1000-2015. For Diameters per NEMA MW1000-1997 see page 34 or visit our website at www.mwswire.com
Blue text above indicates changes from NEMA MW1000-1997 and page 34.

Dimensional values derived from NEMA MW1000-2015 Standard

Copper

SIZE (AWG)	BARE COPPER									HEAVY BUILD			SIZE (AWG)
	DIMENSIONS (INCHES)			RESISTANCE* (OHMS PER 1000 FT. AT 20°C)			SQUARE MILS	CORNER RADIUS	POUNDS PER 1000 FT.	DIMENSIONS (INCHES)			
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	NOM.	NOM.		MIN. INCREASE	MIN. O.D.	MAX. O.D.	
1	.2864	.2893	.2922	.09627	.09895	.1020	82320	.039	317.2	.003	.2894	.2972	1
2	.2550	.2576	.2602	.1217	.1253	.1295	64980	.039	250.4	.003	.2580	.2652	2
3	.2271	.2294	.2317	.1539	.1589	.1648	51250	.039	197.5	.003	.2301	.2367	3
4	.2023	.2043	.2063	.1949	.2018	.2100	40370	.039	155.6	.003	.2053	.2113	4
5	.1801	.1819	.1837	.2470	.2568	.2689	31710	.039	122.2	.003	.1831	.1887	5
6	.1604	.1620	.1636	.3101	.3211	.3345	25360	.031	97.75	.003	.1634	.1686	6
7	.1429	.1443	.1457	.3929	.4084	.4277	19940	.031	76.86	.003	.1459	.1507	7
8	.1272	.1285	.1298	.4981	.5210	.5501	15630	.031	60.25	.003	.1302	.1348	8
9	.1133	.1144	.1155	.6267	.6513	.6812	12510	.026	48.20	.003	.1163	.1205	9
10	.1009	.1019	.1029	.7951	.8309	.8757	9803	.026	37.78	.003	.1039	.1079	10
11	.0897	.0907	.0917	.9914	1.033	1.085	7883	.020	30.38	.003	.0927	.0967	11
12	.0798	.0808	.0818	1.254	1.317	1.397	6185	.020	23.84	.003	.0828	.0868	12
13	.0710	.0720	.0730	1.565	1.641	1.734	4964	.016	19.13	.003	.0740	.0780	13
14	.0631	.0641	.0651	1.980	2.094	2.239	3889	.016	14.99	.003	.0661	.0701	14

*Based on 100% conductivity IACS

Aluminum

SIZE (AWG)	BARE ALUMINUM									HEAVY BUILD			SIZE (AWG)
	DIMENSIONS (INCHES)			RESISTANCE* (OHMS PER 1000 FT. AT 20°C)			SQUARE MILS	CORNER RADIUS	POUNDS PER 1000 FT.	DIMENSIONS (INCHES)			
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	NOM.	NOM.		MIN. INCREASE	MIN. O.D.	MAX. O.D.	
1	.2864	.2893	.2922	.1558	.1601	.1650	82320	.039	96.46	.003	.2894	.2972	1
2	.2550	.2576	.2602	.1969	.2028	.2096	64980	.039	76.15	.003	.2580	.2652	2
3	.2271	.2294	.2317	.2491	.2572	.2666	51250	.039	60.06	.003	.2301	.2367	3
4	.2023	.2043	.2063	.3154	.3265	.3399	40370	.039	47.30	.003	.2053	.2113	4
5	.1801	.1819	.1837	.3997	.4156	.4351	31710	.039	37.16	.003	.1831	.1887	5
6	.1604	.1620	.1636	.5017	.5196	.5412	25360	.031	29.72	.003	.1634	.1686	6
7	.1429	.1443	.1457	.6357	.6609	.6920	19940	.031	23.37	.003	.1459	.1507	7
8	.1272	.1285	.1298	.8059	.8431	.8902	15630	.031	18.32	.003	.1302	.1348	8
9	.1133	.1144	.1155	1.014	1.054	1.102	12510	.026	14.66	.003	.1163	.1205	9
10	.1009	.1019	.1029	1.286	1.344	1.417	9803	.026	11.49	.003	.1039	.1079	10
11	.0897	.0907	.0917	1.604	1.672	1.755	7883	.020	9.237	.003	.0927	.0967	11
12	.0798	.0808	.0818	2.028	2.131	2.260	6185	.020	7.248	.003	.0828	.0868	12
13	.0710	.0720	.0730	2.532	2.655	2.806	4964	.016	5.817	.003	.0740	.0780	13
14	.0631	.0641	.0651	3.203	3.389	3.623	3889	.016	4.557	.003	.0661	.0701	14

*Based on 61.8% conductivity IACS

Bondable Magnet Wire

Bondable magnet wire, also referred to as self-bonding magnet wire, is film insulated wire top-coated with a thermoplastic adhesive. When activated, the thermoplastic bonds turn to turn windings to produce self-supporting coils or coils of unusual or difficult configuration. Use of bondable magnet wire may offer advantages over conventional magnet wire in certain winding applications, eliminating the need for bobbins as well as taping or varnishing steps. Activation of the bondcoat may be achieved with either heat, or in some cases solvent, or a combination of the two. Although bondcoats may be added to any conventional film, consideration should be given to the resoftening temperature of the adhesive in that it may not withstand the operating temperature of higher rated primary insulations.

Bonding Methods

Solvent Bonding
Some bondcoats can be activated by applying certain solvents during or after the coil winding process. Application of the solvent, usually via saturated wick during winding, causes the bondcoat to reflow. The process requires the use of a fixture to hold the coil in place while the solvent is drying. Once dry, the coil should be heated to dry off any residual solvent which might cause long-term coil failure, as well as to complete the bonding process.

Heat Bonding
All bondcoats can be heat bonded, either by oven-heating or by directing hot air on to the wire during winding. In either case, the principle is to heat the winding slightly above the bondcoat's reflow temperature and then cool it below its rated bond strength temperature. Oven bonding is accomplished by heating the coil for a period of time sufficient to obtain uniform heating throughout the winding, followed by a cooling cycle. Heating time is generally 10 to 30 minutes, depending on the size of the winding. Disadvantages of oven bonding are the longer bonding time as well as the potential need for many winding fixtures. Hot air bonding, though done typically at slower winding speed, has the advantage of the elimination of a secondary bonding operation. This method is cost effective and usually associated with low temperature bondcoats and wire sizes smaller than 34 AWG.

Resistance Bonding
Resistance bonding is done by applying electric current to the winding to electrically heat it to the proper bond temperature. Bonding voltage and time are dependent on wire size and coil design, and therefore will need to be developed experimentally for each specific application. This method has the advantages of being quick and generating uniform heat distribution. It is typically used for wire sizes heavier than 34 AWG.

Bondable Overcoats

TYPE	SOLVENT ACTIVATION	BONDING TEMPERATURE (°C)*	SOFTENING TEMPERATURE (°C)**
Polyvinyl Butyral	Alcohol	110 -140	105
Epoxy	MEK	150 - 200	130
Polyester	MEK	190 - 210	130
Polyamide	None	200 - 230	180

*May vary based on wire size and coil design
**Most room temperature bond strength lost at this point

Values below derived from NEMA MW1000-2015 Standard

SIZE (AWG)	BARE WIRE DIAMETER (INCHES)			TYPE 1				TYPE 2				SIZE (AWG)
				MIN. INCREASE IN DIAMETER (INCHES)		OVERALL DIAMETER (INCHES)		MIN. INCREASE IN DIAMETER (INCHES)		OVERALL DIAMETER (INCHES)		
	MIN.	NOM.	MAX.	FILM	BOND COAT	MIN.	MAX.	FILM	BOND COAT	MIN.	MAX.	
14	.0635	.0641	.0647	.0016	.0006	.0657	.0682	.0032	.0006	.0673	.0698	14
15	.0565	.0571	.0577	.0015	.0006	.0586	.0610	.0030	.0006	.0601	.0625	15
16	.0503	.0508	.0513	.0014	.0006	.0523	.0545	.0029	.0006	.0538	.0560	16
17	.0448	.0453	.0458	.0014	.0006	.0468	.0488	.0028	.0006	.0482	.0502	17
18	.0399	.0403	.0407	.0013	.0006	.0418	.0437	.0026	.0006	.0431	.0450	18
19	.0355	.0359	.0363	.0012	.0006	.0373	.0391	.0025	.0006	.0386	.0404	19
20	.0317	.0320	.0323	.0012	.0005	.0334	.0351	.0024	.0005	.0346	.0363	20
21	.0282	.0285	.0288	.0011	.0005	.0298	.0315	.0022	.0005	.0309	.0326	21
22	.0250	.0253	.0256	.0011	.0005	.0266	.0281	.0021	.0005	.0276	.0292	22
23	.0224	.0226	.0228	.0010	.0005	.0239	.0253	.0020	.0005	.0249	.0263	23
24	.0199	.0201	.0203	.0010	.0005	.0214	.0227	.0019	.0005	.0223	.0236	24
25	.0177	.0179	.0181	.0009	.0005	.0191	.0203	.0018	.0005	.0200	.0212	25
26	.0157	.0159	.0161	.0009	.0005	.0171	.0182	.0017	.0005	.0179	.0191	26
27	.0141	.0142	.0143	.0008	.0005	.0154	.0165	.0016	.0005	.0162	.0173	27
28	.0125	.0126	.0127	.0008	.0005	.0138	.0147	.0016	.0005	.0146	.0155	28
29	.0112	.0113	.0114	.0007	.0004	.0123	.0133	.0015	.0004	.0131	.0141	29
30	.0099	.0100	.0101	.0007	.0004	.0110	.0121	.0013	.0004	.0116	.0128	30
31	.0088	.0089	.0090	.0006	.0004	.0098	.0108	.0012	.0004	.0104	.0114	31
32	.0079	.0080	.0081	.0006	.0004	.0089	.0097	.0011	.0004	.0094	.0103	32
33	.0070	.0071	.0072	.0005	.0003	.0078	.0087	.0010	.0003	.0083	.0092	33
34	.0062	.0063	.0064	.0005	.0003	.0070	.0078	.0009	.0003	.0074	.0083	34
35	.0055	.0056	.0057	.0004	.0003	.0062	.0070	.0009	.0003	.0067	.0075	35
36	.0049	.0050	.0051	.0004	.0003	.0056	.0063	.0008	.0003	.0060	.0067	36
37	.0044	.0045	.0046	.0004	.0003	.0051	.0057	.0007	.0003	.0054	.0061	37
38	.0039	.0040	.0041	.0003	.0002	.0044	.0051	.0007	.0002	.0048	.0055	38
39	.0034	.0035	.0036	.0003	.0002	.0039	.0045	.0006	.0002	.0042	.0049	39
40	.0030	.0031	.0032	.0003	.0002	.0035	.0041	.0005	.0002	.0037	.0044	40
41	.0027	.0028	.0029	.0003	.0002	.0032	.0037	.0005	.0002	.0034	.0040	41
42	.0024	.0025	.0026	.0002	.0002	.0028	.0033	.0005	.0002	.0031	.0036	42
43	.0021	.0022	.0023	.0002	.0001	.0024	.0029	.0004	.0001	.0026	.0032	43
44	.0019	.0020	.0021	.0002	.0001	.0022	.0026	.0004	.0001	.0024	.0029	44
45	.00169	.00176	.00183	.0002	.0001	.00199	.0024	.0004	.0001	.00219	.0027	45
46	.00151	.00157	.00164	.0002	.0001	.00181	.0021	.0003	.0001	.00191	.0024	46
47	.00135	.00140	.00146	.0001	.0001	.00155	.0019	.0003	.0001	.00175	.0021	47
48	.00119	.00124	.00129	.0001	.0001	.00139	.0017	.0002	.0001	.00149	.0019	48
49	.00107	.00111	.00116	.0001	.0001	.00127	.0015	.0002	.0001	.00137	.0017	49
50	.00095	.0009	.00103	.0001	.0001	.00115	.0014	.0002	.0001	.00125	.0016	50
51	.00085	.00088	.00092	.0001	.0001	.00105	.0013	-	-	-	-	51
52	.00075	.00078	.00081	.0001	.00005	.00090	.00115	-	-	-	-	52

Diameters shown are per NEMA MW1000-2015. For Diameters per NEMA MW1000-1997 see page 35 or visit our website at www.mwswire.com

Blue text above indicates changes from NEMA MW1000-1997 and page 35.

Bondable wire sizes finer than 52 AWG available upon request.

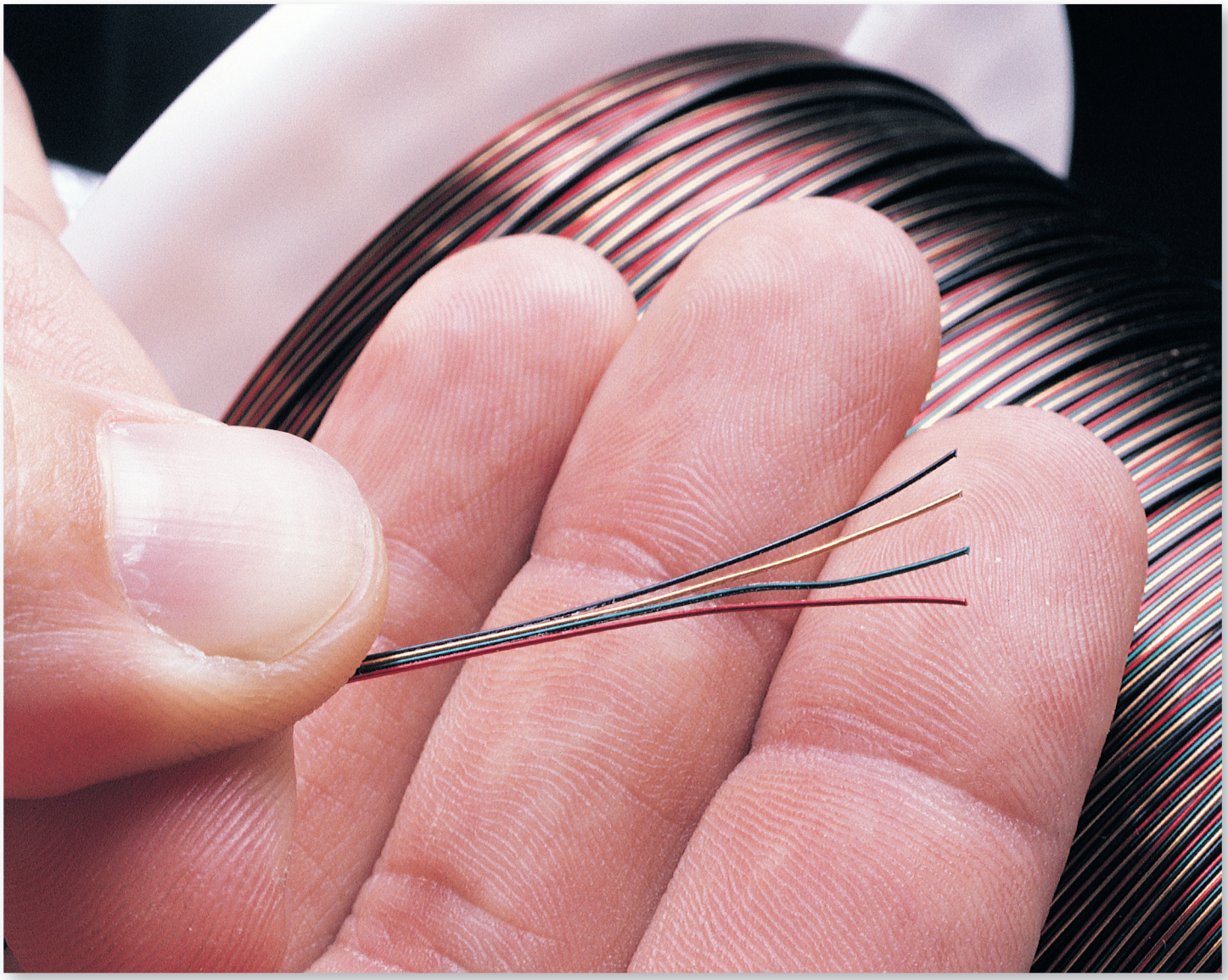
Bondable Wire Grades - Types Defined

TYPE	INSULATION AND BONDCOAT CONFIGURATION
1	Equal to Single Build* plus bondcoat
2	Equal to Heavy Build* plus bondcoat

The addition of a bondcoat will result in an increase in the finished diameter of the wire.

* For standard round magnet wire insulation build diameters (e.g. Single, Heavy, Triple & Quad) see page 5.

Multifilar® Magnet Wire



Parallel bonded magnet wire for more consistent capacitance and impedance characteristics.

Where constant parallel alignment of multiple strands is an advantage, Multifilar® magnet wire is the right choice. Its parallel-bonded, color-coded construction offers benefits for many applications.

Engineers should specify Multifilar® when concerned with space, weight, and reliability. Where consistent capacitance and impedance characteristics are required, Mulifilar magnet wire outperforms windings using two separate magnet wires.

Production users benefit from increased layer winding speeds, tighter windings that deliver more power in less space, reduced labor and handling. Color coding assists in conductor identification and reduces termination errors.

MWS custom manufactures Multifilar® magnet wire to assure flat, parallel construction in sizes 16 AWG and finer, and up to 20 conductors* wide in some sizes.

Ten insulation colors are offered in polyurethane and poly-nylon films. Red, green and natural are standard for all film types. Consult the chart on the next page for available film insulations and colors.

*For constructions of greater than 20 conductors, call or email our sales department.

General Product Information

INSULATION CODE NO.	INSULATION TYPE	THERMAL CLASS	DIELECTRIC CONSTANT	NEMA MW 1000 DESIGNATION	AVAILABLE COLORS
1	Polyurethane 155	155	3.70	MW 79-C	Red, Green, Natural, Blue, Yellow Black, Violet, Orange, White, Brown
1	Polyurethane 180	180	3.70	MW 82-C	
2	Poly-Nylon 155	155	3.81	MW 80-C	Red, Green, Natural, Blue, Yellow Black, Violet, Orange, White, Brown
2	Poly-Nylon 180	180	3.81	MW 83-C	
4	Polyester 200	200	3.82	MW 74-C	Red, Green, Natural, Black
5	Armored Polyester	200	3.86	MW 35-C	Red, Green, Natural, Black
6	Solderable Polyester	180	3.76	MW 77-C	Red, Green, Natural, Black
7	Formvar	105	7.40	MW 15-C	Red, Green, Natural, Black
8	Polyimide (ML)	240	3.90	MW 16-C	Red, Green, Natural, Black

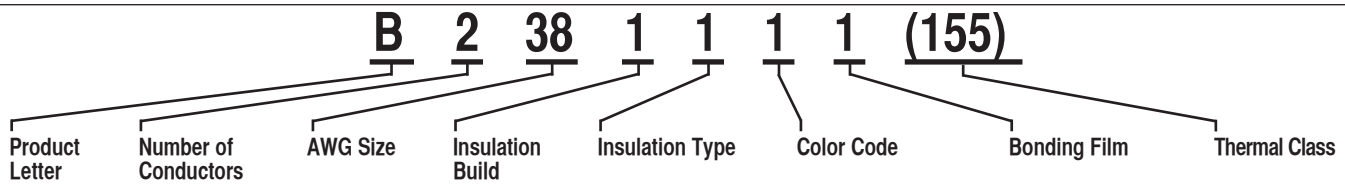
BOND CODE NO.	BOND COAT (Operating Temperature)	SOLVENT*
1	Polyvinyl Butyral (105°C)	Alcohol
2	Nylon (105°C)	None
3	Epoxy (130°C)	MEK or Acetone
4	Polyester (130°C)	None
5	Polyamide (165°C)	None
6	Polyimide (ML) (240°C)	None

*** Bonding films can be softened and removed by immersion in the solvent noted, except nylon, polyester, polyamide and ML which are non-soluble. Wiping with a soft cloth dampened with solvent may be necessary to separate wires.**

Finished wire thermal class based on the underlying enamel of the individual strand.

BOND THICKNESS STANDARDS		
AWG SIZE	THICKNESS	TOLERANCE
16-20	.0007"	± .0002"
21-28	.0005"	± .0002"
29-32	.0004"	± .0001"
33-36	.0003"	± .0001"
37-41	.0002"	± .0001"
42-finer	.0001"	+ .0001"/-0

Part Number Ordering System — Make your own part number by following the guidelines outlined below



Product Letter	Number of Conductors	AWG Size	Insulation Build	Insulation Type	Color Code	Bonding Film	Thermal Class
For all Multifilar magnet wire	Use ( ) for more than 9 conductors		1 = single 2 = heavy 3 = triple 4 = quadruple	See above chart for correct code number	0 = none required 1 = red/green 2 = green/clear 3 = red/green/clear 4 = red/green/clear/blue 9 = special — call for color code	See above chart for correct code number	For Poly and Poly-Nylon insulations specify 155 or 180 thermal class

EXAMPLE = 2 Conductors — 38 AWG Single Polyurethane 155° — Red/Green — Butyral Bond

Twistite™ Magnet Wire

For superior performance and tighter control over twisted wire construction.

For those who use twisted magnet wire in the production of custom toroid, ferrite and recording head coils, specialty audio and R.F. transformers, Twistite magnet wire offers several advantages over other twisted magnet wire constructions.

Because Twistite is custom produced by MWS, a wider range of twisting constructions is possible.

Manufacturing capabilities include:

- Up to 50 twists per inch on fine wire
- Twisting tolerance as tight as ±1%
- Tightly controlled capacitance, inductance and impedance characteristics
- Up to 10 colors in some sizes for conductor identification
- Huge selection of insulations 105 - 240°C (single through quadruple film builds - See page 5)
- Wide range of sizes: 16 through 52 AWG
- Wide variety of conductor materials: copper, silver, plated conductors, and specialty alloys

Part Number Ordering System — Make your own part number by following the guidelines outlined below

T - 3 38 1 2 2 3 - 10 (155)

Product Letter	Number of Conductors	AWG Size	Conductor Material	Insulation Build	Insulation Type*	Color Code	Twisting Tightness	Thermal Class
For all Twistite magnet wire	Use ( ) for more than 9 conductors	Use 88 for special size	1 = Copper 2 = Silver 3 = Aluminum 4 = Silver Plated Copper 5 = Gold Plated Copper 9 = special	1 = single 2 = heavy 3 = triple 4 = quadruple 9 = special	1 = Polyurethane - 155 / 180 2 = Poly-Nylon - 155 / 180 3 = Polyester - 180 4 = Polyester - 200 5 = Polyurethane bondable 6 = Solderable Polyester - 180 7 = Formvar 8 = ML 9 = special	0 = none required 1 = red/green 2 = green/natural 3 = red/green/natural 4 = red/green/natural/blue 9 = special	Number of twists per inch	For Poly and Poly-Nylon insulations specify 155 or 180 thermal class

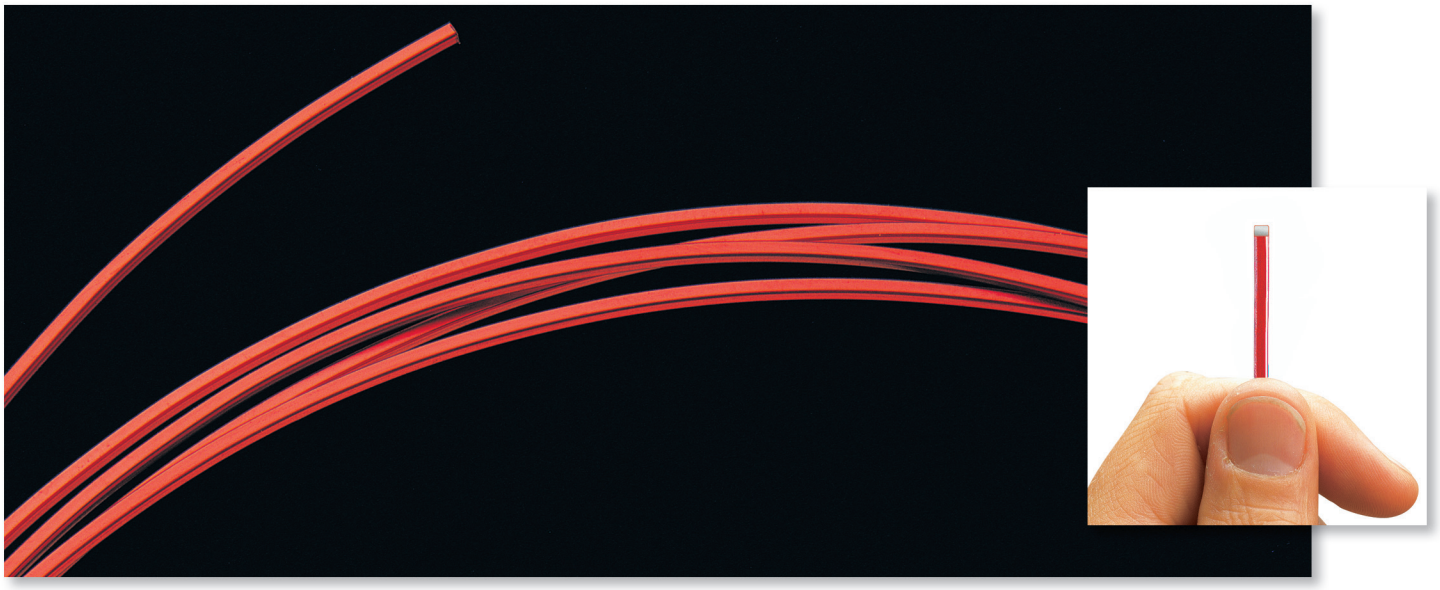
EXAMPLE = 3/38 Copper - Heavy Poly Nylon 155°C - Red/Green/Natural - 10 Twists Per Inch

*See pages 2 and 3 for a complete listing of insulations. Twistite™ is a trademark of MWS Wire Industries

NUMBER OF STRANDS	SIZE (AWG)	CIRCULAR MILS	NEAREST AWG EQUIV. (CIR. MILS)	RESISTANCE (OHMS PER 1000 FT. AT 20°C)	SINGLE BUILD			HEAVY BUILD		
					MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.	MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.
		NOMINAL		NOMINAL	NOMINAL			NOMINAL		
2	24	808.00	21	12.83	.043	402	2.49	.045	395	2.53
3	24	1212.00	19½	8.56	.043	268	3.73	.045	263	3.79
6	24	2424.00	16½	4.28	.060	134	7.46	.063	132	7.59
2	25	641.00	22	16.18	.038	505	1.98	.040	496	2.02
3	25	961.00	20½	10.79	.038	337	2.97	.040	331	3.03
6	25	1922.00	17½	5.39	.054	168	5.94	.057	165	6.05
2	26	506.00	23	20.51	.034	639	1.56	.036	627	1.60
3	26	758.00	21½	13.67	.034	426	2.35	.036	418	2.39
6	26	1517.00	18½	6.84	.048	213	4.69	.051	209	4.79
2	27	403.00	24	25.71	.031	800	1.25	.032	785	1.27
3	27	605.00	22½	17.14	.031	533	1.87	.032	524	1.19
6	27	1210.00	19½	8.57	.043	267	3.75	.046	261	3.82
2	28	318.00	25	32.66	.027	1014	.986	.029	993	1.01
3	28	476.00	23½	21.78	.027	676	1.48	.029	662	1.51
6	28	953.00	20½	10.89	.039	338	2.96	.041	331	3.02
2	29	255.00	26	40.61	.025	1256	.787	.026	1231	.812
3	29	383.00	24½	27.07	.025	838	1.19	.026	821	1.22
6	29	766.00	21½	13.54	.035	419	2.39	.037	410	2.44
2	30	200.00	27	51.85	.022	1604	.623	.023	1568	.638
3	30	300.00	25½	34.57	.022	1068	.936	.023	1048	.954
6	30	600.00	22½	17.29	.031	534	1.87	.033	524	1.91
2	32	128.00	29	81.05	.0176	2498	.400	.019	2436	.410
3	32	192.00	27	54.00	.018	1695	.590	.019	1651	.606
6	32	384.00	24	27.00	.025	848	1.18	.027	826	1.21
2	34	79.00	31	130.65	.014	4027	.248	.015	3918	.255
3	34	119.00	29½	87.10	.014	2680	.373	.015	2627	.381
6	34	238.00	26½	43.55	.020	1340	.746	.021	1313	.762
2	36	50.00	33	207.40	.0112	6400	.156	.012	6190	.162
3	36	75.00	31	138.27	.011	4230	.236	.012	4151	.241
6	36	150.00	28½	69.13	.016	2115	.473	.017	2076	.482
2	38	32.00	35	324.10	.009	10010	.100	.0098	9680	.103
3	38	48.00	33	216.07	.009	6748	.148	.010	6549	.135
6	38	96.00	30	108.03	.013	3374	.296	.014	3274	.305
2	40	19.22	37	539.50	.007	16665	.060	.0076	15970	.063
3	40	28.83	35½	359.73	.007	10650	.0939	.008	10449	.0957
6	40	57.66	32½	179.87	.010	5325	.188	.011	5225	.1941
2	41	15.68	38	661.50	.0062	20400	.049	.0068	19670	.051
3	41	23.52	36½	441.00	.006	13495	.0741	.007	13228	.0756
6	41	47.04	33½	220.50	.009	6748	.148	.010	6614	.151
2	42	12.50	39	829.50	.0056	25470	.039	.006	24800	.040
3	42	18.75	37½	553.00	.006	17129	.0584	.006	16750	.0597
6	42	37.50	34½	276.50	.008	8564	.117	.009	8375	.119
2	43	9.68	40	1071.00	.005	33070	.030	.0054	31585	.032
3	43	14.52	38½	714.33	.005	21533	.0464	.005	20964	.0477
6	43	29.04	35½	357.17	.007	10767	.0929	.008	10482	.0954
2	44	8.00	41	1296.00	.0044	40030	.025	.005	38080	.026
3	44	12.00	39	864.33	.004	27034	.0370	.005	26247	.0381
6	44	24.00	36	432.17	.006	13517	.0740	.007	13123	.0762
2	45	6.20	42	1674.00	.0039	51750	.019	.0043	49555	.020
3	45	9.30	40½	1116.00	.0040	34500	.0290	.0045	33033	.0303
6	45	18.60	37½	558.00	.0055	17250	.0580	.0060	16517	.0605
2	46	4.94	43	2103.00	.0035	65000	.015	.0039	61900	.016
3	46	7.41	41	1402.23	.0035	43367	.0231	.0040	41267	.0242
6	46	17.82	38½	701.16	.0050	21683	.0461	.0055	20633	.0485
2	47	3.92	44	2645.00	.0032	81700	.012	.0036	77800	.013
3	47	5.88	42½	1763.67	.0030	54100	.0185	.0035	51533	.0194
6	47	11.76	39	881.83	.0045	27050	.0370	.0050	25767	.0388
2	48	3.08	45	3372.00	.0028	102450	.0098	.0031	98450	.0101
3	48	4.62	43	2248.33	.0030	68333	.0146	.0030	65567	.0153
6	48	9.24	40	1124.16	.0040	34167	.0293	.0045	32783	.0305

For twisted constructions not listed on this page, call or email our sales department.

Microsquare™ Magnet Wire



Miniature square and rectangular magnet wire for specialty coil and motor windings.

When product miniaturization calls for tighter dimensional specifications, MWS Microsquare film-coated magnet wire allows design engineers to create compact coils and small motors that deliver more power in less space.

Microsquare means miniature square and rectangular, copper and aluminum magnet wire. Custom-produced by MWS in sizes smaller than 14 AWG or 3500 sq. mil. cross-sectional area, Microsquare is available in a wide range of solderable and high-temperature insulations and a variety of colors, with or without bondable overcoats. See pages 2 and 3 for information on film insulations and pages 8 and 9 for information on bondable overcoats. Microsquare magnet wire was developed to provide improved winding uniformity and maximum use of space.

Cross Section at 100X

#28 Square Copper Insulated, with polyester base coat and epoxy bondable topcoat.

Part Number Ordering System — Make your own part number by following the guidelines outlined below

M 22 1 1 2 1 (155)

Product Letter	Square AWG Size	Conductor Material	Insulation Build	Insulation Type*	Color Code	Thermal Class
For all Microsquare magnet wire	From chart. Use 88 for special square size. Use 99 for rectangular sizes.	1 = Copper 2 = Aluminum 9 = special	1 = single 2 = heavy 3 = triple 4 = quadruple 9 = special	1 = Polyurethane - 155 / 180 2 = Poly-Nylon - 155 / 180 3 = Polyester - 180 4 = Polyester - 200 5 = Polyurethane Bondable 6 = Solderable Polyester - 180 7 = Formvar 8 = ML 9 = special	1 = natural 2 = green 3 = red 4 = blue 9 = special	For Poly and Poly-Nylon insulations specify 155 or 180 thermal class

EXAMPLE = 22 AWG - Square Copper - Single Poly-Nylon 155°C - Natural

NOTE: For part numbers starting with 88 or 99, please show wire dimensions after basic part number.

*See pages 2 and 3 for a complete listing of insulations. Microsquare™ is a trademark of MWS Wire Industries

Copper

SIZE (AWG)	BARE DIMENSION (INCHES) NOM.	BARE WIRE TOLERANCE*	RESISTANCE (OHMS PER 1000 FT. AT 20°C) MIN.	NOM.	MAX.	CORNER RADIUS	SQ. MIL AREA	SIZE (AWG)
15	.0571	± .0005"	2.601	2.761	2.801	.010"	3175	15
16	.0508	± .0005"	3.281	3.483	3.534	.010"	2495	16
17	.0453	± .0005"	4.135	4.390	4.453	.009"	1983	17
18	.0403	± .0005"	5.225	5.546	5.627	.008"	1569	18
19	.0359	± .0005"	6.570	6.975	7.076	.008"	1234	19
20	.0320	± .0004"	8.302	8.685	8.845	.007"	982	20
21	.0285	± .0004"	10.46	10.94	11.15	.006"	781	21
22	.0253	± .0004"	13.17	13.78	14.03	.005"	619	22
23	.0226	± .0004"	16.60	17.37	17.69	.005"	489	23
24	.0201	± .0003"	21.06	22.03	22.44	.005"	383	24
25	.0179	± .0003"	26.00	26.81	27.62	.004"	307	25
26	.0159	± .0003"	32.86	33.88	34.91	.003"	245	26
27	.0142	± .0003"	41.43	42.73	44.02	.003"	194	27
28	.0126	± .0003"	52.51	54.15	55.79	.0025"	153	28
29	.0113	± .0003"	65.83	67.89	69.94	.002"	124	29
30	.0100	± .0003"	83.62	86.24	88.85	.002"	97	30
31	.0089	± .0002"	104.0	107.2	110.5	.0015"	77	31
32	.0080	± .0002"	132.7	136.9	141.0	.0015"	62	32
33	.0071	± .0002"	167.5	172.8	178.0	.001"	49	33
34	.0063	± .0002"	207.4	213.8	220.3	.001"	38	34
35	.0056	± .0002"	263.3	271.5	279.8	.001"	30	35

Aluminum

SIZE (AWG)	BARE DIMENSION (INCHES) NOM.	BARE WIRE TOLERANCE*	RESISTANCE (OHMS PER 1000 FT. AT 20°C) MIN.	NOM.	MAX.	CORNER RADIUS	SQ. MIL AREA	SIZE (AWG)
15	.0571	± .0005"	4.134	4.2624	4.393	.010"	3175	15
16	.0508	± .0005"	5.210	5.372	5.535	.010"	2495	16
17	.0453	± .0005"	6.566	6.722	6.977	.009"	1983	17
18	.0403	± .0005"	8.294	8.554	8.813	.008"	1569	18
19	.0359	± .0005"	10.43	10.76	11.08	.008"	1234	19
20	.0320	± .0004"	13.18	13.60	14.01	.007"	982	20
21	.0285	± .0004"	16.64	17.16	17.68	.006"	781	21
22	.0283	± .0004"	20.86	21.52	22.17	.005"	619	22
23	.0226	± .0004"	26.37	27.19	28.02	.005"	489	23
24	.0201	± .0003"	33.41	34.45	35.50	.005"	383	24
25	.0179	± .0003"	41.98	43.30	44.61	.004"	307	25
26	.0159	± .0003"	52.99	54.65	56.30	.003"	245	26
27	.0142	± .0003"	66.82	68.90	70.99	.003"	194	27
28	.0126	± .0003"	84.74	87.38	90.03	.0025"	153	28
29	.0113	± .0003"	106.2	109.6	112.9	.002"	124	29
30	.0100	± .0003"	134.8	139.0	143.2	.002"	97	30

Minimum and maximum overall dimensions will be the same as those for the equivalent round size.

EXAMPLE: 22 square heavy build: MINIMUM O.D. = .0271"
MAXIMUM O.D. = .0281"

*Conformance to dimensional tolerance is based on the **average** of at least three measurements per axis using a minimum 12" sample length.
Individual measurements outside the tolerance limits will not be cause for rejection.

Litz Wire

The term “litz wire” is derived from the German word *litzendraht*, meaning “woven wire.” Generally defined, it is a wire constructed of individually film-insulated wires bunched or braided together in a uniform pattern of twists and length of lay.

The multistrand configuration minimizes the power losses otherwise encountered in a solid conductor due to the “skin effect,” or the tendency of radio frequency current to be concentrated at the surface of the conductor.

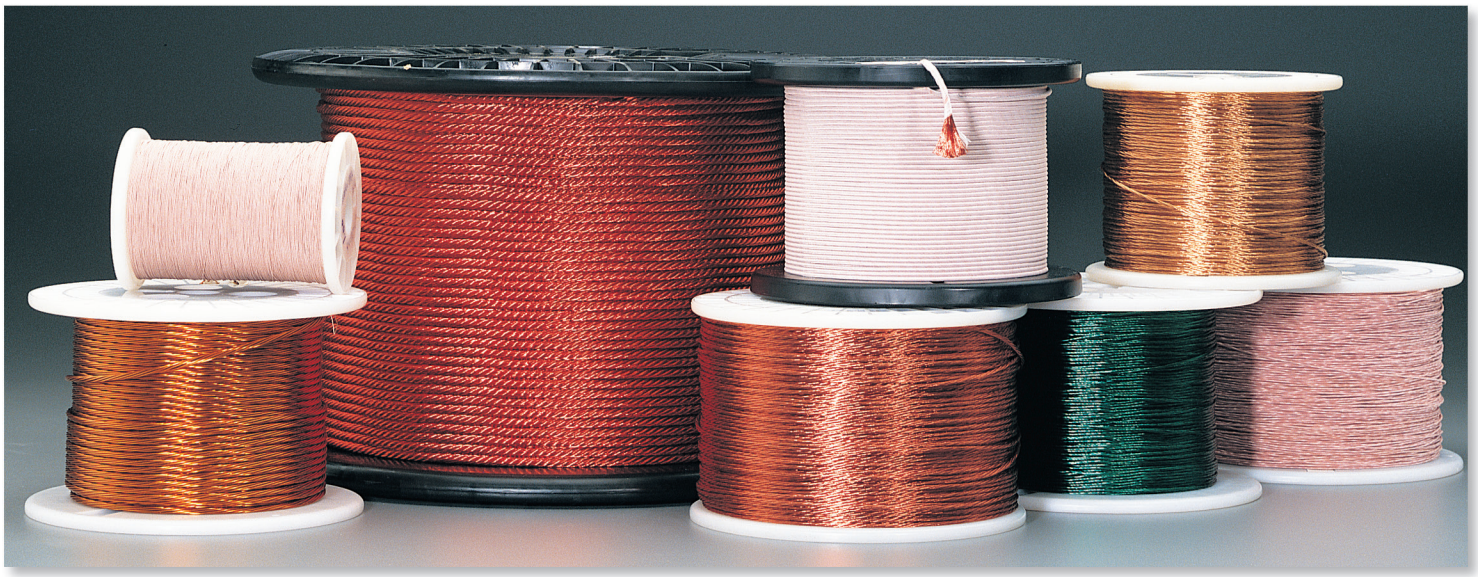
In order to counteract this effect, it is necessary to increase the amount of surface area without appreciably increasing the size of the conductor. It is also essential to position each individual strand in the litz construction in a uniform pattern, moving from the center to the outside and back in a given length.

Even properly constructed litz wires will exhibit some skin effect due to the limitations of stranding. Wires intended for higher frequency ranges require more strands of a finer gauge size than litz wires of equal cross-sectional area, but composed of fewer and larger strands.

Polyurethane and Polyurethane Nylon are the films most often used for insulating individual strands because of their low electrical losses and their solderability. Other insulations shown on pages 2 and 3 can also be used. Litz wires are generally further insulated with a single or double wrap or serving of a textile — typically nylon — but are also available unserved.

The data that follows covers a broad range of sizes but is not intended to represent all possible constructions available. Inquire as to particular litz wire constructions and allow us to provide you with wire to meet your specifications.

NUMBER OF STRANDS	SIZE (AWG)	CIRCULAR MILS	NEAREST AWG EQUIV. (CIR. MILS)	RESISTANCE (OHMS PER 1000 FT. AT 20°C)	UNSERVED						SERVED		
					SINGLE POLYURETHANE			HEAVY POLYURETHANE			SINGLE NYLON — SINGE POLY		
					MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.	MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.	MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.
		NOMINAL		NOMINAL	NOMINAL			NOMINAL			NOMINAL		
3	34	119.07	29½	87.10	.014	2680	.373	.015	2627	.381	.016	2495	.401
4	34	158.76	28	65.33	.016	2010	.498	.017	1970	.508	.018	1889	.529
5	34	198.45	27	52.26	.018	1608	.622	.019	1576	.635	.020	1523	.657
6	34	238.14	26½	43.55	.020	1340	.746	.021	1313	.762	.022	1277	.783
7	34	277.83	25½	37.33	.021	1148	.871	.023	1126	.888	.024	1097	.912
8	34	317.52	25	32.66	.023	1005	.995	.025	985	1.02	.025	963	1.04
9	34	357.21	24½	29.03	.024	893	1.12	.026	876	1.14	.027	856	1.17
10	34	396.90	24	26.13	.026	804	1.24	.027	788	1.27	.028	772	1.30
15	34	595.35	22½	17.42	.031	536	1.87	.034	525	1.91	.034	517	1.93
20	34	793.80	21	13.07	.036	402	2.49	.039	394	2.54	.038	389	2.57
3	36	75.00	31	138.27	.011	4230	.236	.012	4151	.241	.013	3875	.258
4	36	100.00	30	103.70	.013	3173	.315	.014	3113	.321	.015	2941	.340
5	36	125.00	29	82.96	.015	2538	.394	.016	2491	.401	.017	2370	.422
6	36	150.00	28	69.13	.016	2115	.473	.017	2076	.482	.018	1982	.505
7	36	175.00	27½	59.26	.017	1813	.552	.018	1779	.562	.019	1706	.586
8	36	200.00	27	51.85	.018	1586	.631	.020	1557	.642	.021	1499	.667
9	36	225.00	26½	46.09	.019	1410	.709	.021	1384	.723	.022	1337	.748
10	36	250.00	26	41.48	.021	1269	.788	.022	1245	.803	.023	1208	.828
15	36	375.00	24½	27.65	.025	846	1.18	.027	830	1.21	.027	809	1.24
20	36	500.00	23	20.74	.029	635	1.58	.031	623	1.61	.031	611	1.64
25	36	625.00	22	16.59	.032	508	1.97	.035	498	2.01	.035	490	2.04
30	36	750.00	21½	13.83	.035	423	2.36	.038	415	2.41	.038	409	2.44
40	36	1000.00	20	10.37	.041	317	3.16	.044	311	3.22	.043	308	3.25
50	36	1250.00	19	8.30	.046	254	3.94	.049	249	4.02	.048	248	4.03
60	36	1500.00	18½	6.91	.050	212	4.72	.054	208	4.81	.052	208	4.81
3	38	48.00	33	216.07	.009	6748	.148	.010	6549	.135	.011	6080	.164
4	38	64.00	32	162.05	.010	5061	.198	.011	4912	.204	.013	4606	.217
5	38	80.00	31	129.64	.012	4048	.247	.013	3929	.255	.014	3716	.269
6	38	96.00	30	108.03	.013	3374	.296	.014	3274	.305	.015	3121	.320
7	38	112.00	29½	92.60	.014	2892	.346	.015	2807	.356	.016	2681	.373
8	38	128.00	29	81.03	.015	2530	.395	.016	2456	.407	.017	2363	.423
9	38	144.00	28½	72.02	.016	2249	.445	.017	2183	.458	.018	2105	.475
10	38	160.00	28	64.82	.016	2024	.494	.018	1965	.509	.019	1901	.526
15	38	240.00	26½	43.21	.020	1350	.741	.022	1310	.763	.022	1284	.779
20	38	320.00	25	32.41	.023	1012	.988	.025	982	1.02	.025	969	1.03
25	38	400.00	24	25.93	.026	810	1.24	.028	786	1.27	.028	778	1.29
30	38	480.00	23½	21.61	.029	675	1.48	.031	655	1.53	.031	649	1.54
40	38	640.00	22	16.21	.033	506	1.98	.036	491	2.04	.035	489	2.04
50	38	800.00	21	12.96	.037	405	2.47	.040	393	2.55	.039	392	2.55
60	38	960.00	20½	10.80	.040	337	2.97	.044	327	3.06	.043	328	3.05



NUMBER OF STRANDS	SIZE (AWG)	CIRCULAR MILS	NEAREST AWG EQUIV. (CIR. MILS)	RESISTANCE (OHMS PER 1000 FT. AT 20°C)	UNSERVED						SERVED		
					SINGLE POLYURETHANE			HEAVY POLYURETHANE			SINGLE NYLON — SINGE POLY		
		NOMINAL		NOMINAL	MEAN O.D. (INCHES) NOMINAL	FEET PER POUND	POUNDS PER 1000 FT.	MEAN O.D. (INCHES) NOMINAL	FEET PER POUND	POUNDS PER 1000 FT.	MEAN O.D. (INCHES) NOMINAL	FEET PER POUND	POUNDS PER 1000 FT.
3	40	28.83	35½	359.73	.007	10650	.0939	.008	10449	.0957	.009	9276	.108
4	40	38.44	34	269.80	.008	7987	.125	.009	7837	.128	.010	7108	.141
5	40	48.05	33	215.84	.009	6390	.157	.010	6270	.160	.011	5757	.174
6	40	57.66	32½	179.87	.010	5325	.188	.011	5225	.191	.012	4824	.207
7	40	67.27	32	154.17	.011	4564	.219	.012	4478	.223	.013	4162	.240
8	40	76.88	31	134.90	.011	3994	.250	.012	3919	.255	.014	3662	.273
9	40	86.49	30½	119.91	.012	3550	.282	.013	3483	.287	.014	3273	.306
10	40	96.10	30	107.92	.013	3195	.313	.014	3135	.319	.015	2955	.338
15	40	144.15	28½	71.95	.016	2130	.470	.017	2090	.478	.018	1994	.502
20	40	192.20	27	53.96	.018	1597	.626	.020	1567	.638	.020	1508	.663
25	40	240.25	26	43.17	.020	1278	.783	.022	1254	.797	.022	1215	.823
30	40	288.30	25½	35.97	.022	1065	.939	.024	1045	.957	.024	1020	.980
40	40	384.40	24½	26.98	.026	799	1.25	.028	784	1.28	.028	767	1.30
50	40	480.50	23½	21.58	.029	639	1.57	.031	627	1.60	.031	615	1.63
60	40	576.60	22½	17.99	.031	532	1.88	.034	523	1.91	.034	513	1.95
75	40	720.75	21½	14.39	.035	426	2.35	.038	418	2.39	.037	412	2.43
100	40	961.00	20½	10.79	.040	319	3.14	.044	313	3.20	.043	310	3.23
125	40	1201.25	19½	8.63	.045	256	3.91	.049	251	3.98	.047	250	4.00
150	40	1441.50	18½	7.19	.050	213	4.70	.054	209	4.79	.052	209	4.78
175	40	1681.75	18	6.17	.054	183	5.46	.058	179	5.59	.056	180	5.56
3	41	23.52	36	441.00	.006	13495	.0741	.007	13228	.0756	.008	11551	.0866
4	41	31.36	35	330.75	.007	10122	.0990	.008	9921	.108	.009	8867	.113
5	41	39.20	34	264.60	.008	8097	.124	.009	7937	.126	.010	7198	.139
6	41	47.04	33	220.50	.009	6748	.148	.010	6614	.151	.011	6066	.165
7	41	54.88	32½	189.00	.010	5784	.173	.010	5669	.176	.012	5235	.191
8	41	62.72	32	156.38	.010	5061	.198	.011	4960	.202	.012	4600	.217
9	41	70.56	31½	147.00	.011	4498	.222	.012	4409	.227	.013	4111	.243
10	41	78.40	31	132.30	.011	4049	.247	.012	3968	.252	.014	3717	.269
15	41	117.60	29½	88.20	.014	2699	.371	.015	2646	.378	.016	2515	.398
20	41	156.80	28	66.15	.016	2024	.494	.018	1984	.504	.018	1899	.527
25	41	196.00	27	52.92	.018	1619	.618	.020	1587	.630	.020	1528	.654
30	41	235.20	26½	44.10	.020	1350	.741	.022	1323	.756	.022	1283	.779
40	41	313.60	25	33.08	.023	1012	.988	.025	992	1.01	.025	970	1.03
50	41	392.00	24	26.46	.025	810	1.24	.028	794	1.26	.028	778	1.29
60	41	470.40	23½	22.05	.028	675	1.48	.030	661	1.51	.030	649	1.54
75	41	588.00	22½	17.64	.031	540	1.85	.034	529	1.89	.033	521	1.92
100	41	784.00	21	13.23	.036	405	2.47	.039	397	2.52	.038	392	2.55
125	41	980.00	20	10.58	.040	342	3.09	.044	317	3.15	.042	315	3.17
150	41	1176.00	19½	8.82	.044	270	3.70	.048	265	3.77	.046	264	3.79
175	41	1372.00	18½	7.56	.047	231	4.33	.052	227	4.41	.050	226	4.42

Litz Wire

NUMBER OF STRANDS	SIZE (AWG)	CIRCULAR MILS	NEAREST AWG EQUIV. (CIR. MILS)	RESISTANCE (OHMS PER 1000 FT. AT 20°C)	UNSERVED						SERVED		
					SINGLE POLYURETHANE			HEAVY POLYURETHANE			SINGLE NYLON — SINGE POLY		
					MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.	MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.	MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.
		NOMINAL		NOMINAL	NOMINAL			NOMINAL			NOMINAL		
3	42	18.75	37½	553.00	.006	17129	.0584	.006	16750	.0597	.008	14354	.0697
4	42	25.00	36	414.75	.007	12847	.0778	.007	12563	.0796	.009	11048	.0905
5	42	31.25	35	3321.80	.007	10277	.0973	.008	10050	.0995	.009	8992	.111
6	42	37.50	34½	276.50	.008	8564	.117	.009	8375	.119	.010	7596	.132
7	42	43.75	33½	237.00	.009	7341	.136	.009	7179	.139	.011	6570	.152
8	42	50.00	33	207.38	.009	6423	.156	.010	6281	.159	.011	5794	.173
9	42	56.25	32½	184.33	.010	5710	.175	.010	5583	.179	.012	5168	.193
10	42	62.50	32	165.90	.010	5139	.195	.011	5025	.199	.012	4671	.214
15	42	93.75	30½	110.60	.013	3426	.292	.013	3350	.299	.015	3166	.316
20	42	125.00	29	82.95	.015	2569	.389	.016	2513	.398	.017	2399	.417
25	42	156.25	28	66.36	.016	2055	.487	.017	2010	.498	.018	1928	.519
30	42	187.50	27½	55.30	.018	1713	.584	.019	1675	.597	.020	1615	.619
40	42	250.00	26	41.48	.021	1285	.778	.022	1256	.796	.023	1223	.818
50	42	312.50	25	33.18	.023	1028	.973	.025	1005	.995	.025	985	1.02
60	42	375.00	24½	27.65	.025	856	1.17	.027	838	1.19	.027	822	1.22
75	42	468.75	23½	22.12	.028	685	1.46	.030	670	1.49	.030	659	1.52
100	42	625.00	22	16.59	.032	514	1.95	.035	503	1.99	.035	496	2.02
125	42	781.25	21	13.27	.036	411	2.43	.039	402	2.49	.038	398	2.51
150	42	937.50	20½	11.06	.040	343	2.92	.042	335	2.99	.042	333	3.00
175	42	1093.75	19½	9.48	.043	294	3.40	.046	287	3.48	.045	286	3.50
3	43	14.52	38½	714.33	.005	21533	.0464	.005	20964	.0477	.007	17614	.0568
4	43	19.36	37	535.75	.006	16150	.0619	.006	15723	.0636	.008	13598	.0735
5	43	24.20	36	428.60	.007	12920	.0774	.007	12579	.0795	.009	11072	.0903
6	43	29.04	35½	357.17	.007	10767	.0929	.008	10482	.0954	.009	9378	.107
10	43	48.40	33	214.30	.009	6460	.155	.010	6289	.159	.011	5814	.172
20	43	96.80	30	107.15	.013	3230	.310	.014	3145	.318	.015	2991	.334
30	43	145.20	28½	71.43	.016	2153	.464	.017	2096	.477	.018	2015	.496
60	43	290.40	25½	35.72	.022	1077	.929	.024	1048	.954	.025	1032	.969
100	43	484.00	23	21.43	.029	646	1.55	.031	629	1.59	.031	621	1.61
150	43	726.00	21½	14.29	.035	431	2.32	.038	419	2.39	.038	417	2.40
3	44	12.00	39	864.33	.004	27034	.0370	.005	26247	.0381	.007	21303	.0469
4	44	16.00	38	648.25	.005	20276	.0493	.006	19685	.0508	.007	16748	.0597
5	44	20.00	37	518.60	.006	16221	.0616	.007	15748	.0635	.008	13691	.0730
6	44	24.00	36	432.17	.006	13517	.0740	.007	13123	.0762	.008	11598	.0862
7	44	28.00	35½	370.43	.007	11586	.0863	.008	11249	.0889	.009	10057	.0994
8	44	32.00	35	324.13	.007	10138	.0986	.008	9843	.102	.009	8891	.112
9	44	36.00	34½	288.10	.008	9011	.111	.009	8749	.114	.010	7966	.126
10	44	40.00	34	259.30	.008	8110	.123	.009	7874	.127	.010	7218	.139
15	44	60.00	32½	172.87	.010	5407	.185	.011	5349	.191	.012	4910	.204
20	44	80.00	31	129.65	.011	4055	.247	.013	3937	.254	.014	3722	.269
25	44	100.00	30	103.72	.013	3244	.308	.014	3150	.317	.015	3007	.333
30	44	120.00	29	86.43	.014	2703	.370	.016	2625	.381	.016	2519	.397
40	44	160.00	28	64.83	.016	2028	.493	.018	1969	.508	.018	1904	.525
50	44	200.00	27	51.86	.018	1622	.617	.020	1575	.635	.020	1533	.652
60	44	240.00	26½	43.22	.020	1352	.740	.022	1312	.762	.022	1286	.778
75	44	300.00	25½	34.57	.022	1081	.925	.025	1050	.952	.024	1036	.965
100	44	400.00	24	25.93	.025	811	1.23	.029	787	1.27	.028	779	1.28
125	44	500.00	23	20.74	.028	649	1.54	.032	630	1.59	.031	624	1.60
150	44	600.00	22½	17.29	.031	541	1.85	.035	525	1.90	.033	522	1.92
175	44	700.00	21½	14.82	.034	463	2.16	.038	450	2.22	.036	448	2.23
3	45	9.30	40½	1116.00	.0040	34500	.0290	.0045	33033	.0303	.0060	26358	.0379
4	45	12.40	39	837.00	.0045	25875	.0386	.0050	24775	.0404	.0065	20803	.0481
5	45	15.50	38	669.60	.0050	20700	.0483	.0055	19820	.0505	.0070	17056	.0586
6	45	18.60	37½	558.00	.0055	17250	.0580	.0060	16517	.0605	.0075	14455	.0692
10	45	31.00	35	334.80	.0070	10350	.0966	.0080	9910	.101	.0095	9056	.110

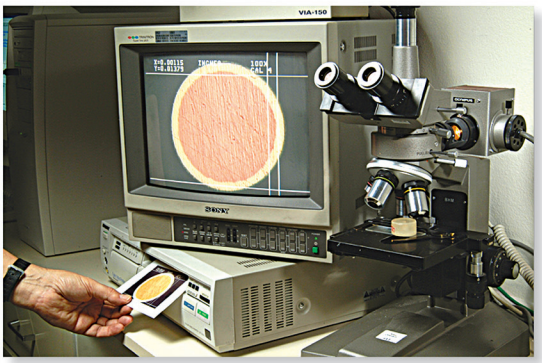
NUMBER OF STRANDS	SIZE (AWG)	CIRCULAR MILS	NEAREST AWG EQUIV. (CIR. MILS)	RESISTANCE (OHMS PER 1000 FT. AT 20°C)	UNSERVED						SERVED		
					SINGLE POLYURETHANE			HEAVY POLYURETHANE			SINGLE NYLON — SINGE POLY		
					MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.	MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.	MEAN O.D. (INCHES)	FEET PER POUND	POUNDS PER 1000 FT.
		NOMINAL		NOMINAL	NOMINAL			NOMINAL			NOMINAL		
20	45	62.00	32	167.40	.010	5175	.193	.011	4955	.202	.012	4704	.213
30	45	93.00	30	111.60	.012	3450	.290	.014	3303	.303	.014	3188	.314
60	45	186.00	27½	55.80	.017	1725	.580	.019	1652	.605	.019	1627	.614
100	45	310.00	25	33.48	.022	1035	.966	.025	991	1.01	.024	992	1.01
150	45	465.00	23½	22.32	.027	690	1.45	.030	661	1.51	.029	664	1.51
3	46	7.41	41	1402.23	.0035	43367	.0231	.0040	41267	.0242	.0055	31224	.0320
4	46	9.88	40	1051.75	.0040	32525	.0307	.0045	30950	.0323	.0060	24686	.0405
5	46	12.35	39	841.40	.0045	26020	.0384	.0050	24760	.0404	.0065	20842	.0480
6	46	14.82	38½	701.16	.0050	21683	.0461	.0055	20633	.0485	.0070	17780	.0562
7	46	17.29	37½	601.00	.0055	18586	.0538	.0060	17686	.0565	.0075	15500	.0645
8	46	19.76	37	525.87	.0055	16263	.0615	.0065	15475	.0646	.0080	13709	.0729
9	46	22.23	36½	467.40	.0060	14456	.0692	.0070	13756	.0727	.0080	12316	.0812
10	46	24.70	36	420.70	.0065	13010	.0769	.0075	12380	.0808	.0085	11188	.0894
15	46	37.05	34	280.46	.0080	8673	.115	.0090	8253	.121	.010	7684	.130
20	46	49.40	33	210.35	.0090	6505	.154	.010	6190	.162	.011	5861	.171
25	46	61.75	32	168.28	.010	5204	.192	.011	4952	.202	.012	4730	.211
30	46	74.10	31½	140.22	.011	4337	.231	.012	4127	.242	.013	3972	.252
40	46	98.80	30	105.18	.013	3253	.307	.014	3095	.323	.015	3016	.332
50	46	123.50	29	84.14	.014	2602	.384	.016	2476	.404	.016	2430	.412
60	46	148.20	28½	70.12	.016	2168	.461	.018	2063	.485	.018	2031	.492
75	46	185.25	27½	56.09	.017	1735	.576	.020	1651	.606	.020	1634	.612
100	46	247.00	26	42.07	.020	1301	.769	.023	1238	.808	.022	1239	.807
125	46	308.75	25	33.66	.022	1041	.961	.025	990	1.01	.025	997	1.00
150	46	370.50	24½	28.05	.025	867	1.15	.028	825	1.21	.027	832	1.20
175	46	432.25	23½	24.04	.026	743	1.35	.030	707	1.41	.029	714	1.40
3	47	5.88	42½	1763.67	.0030	54100	.0185	.0035	51533	.0194	.0055	35976	.0278
4	47	7.84	41	1322.75	.0035	40575	.0246	.0040	38650	.0259	.0060	30228	.0331
5	47	9.80	40	1058.20	.0040	32460	.0308	.0045	30920	.0323	.0065	25188	.0397
6	47	11.76	39	881.83	.0045	27050	.0370	.0050	25767	.0388	.0065	21558	.0464
10	47	19.60	37	529.10	.0060	16230	.0616	.0065	15460	.0647	.0080	13681	.0731
20	47	39.20	34	264.55	.0080	8115	.123	.0090	7730	.129	.010	7214	.139
30	47	58.80	32½	176.37	.010	5410	.185	.011	5153	.194	.012	4896	.204
60	47	117.60	29½	88.18	.014	2705	.370	.016	2577	.388	.016	2521	.397
100	47	196.00	27	52.91	.018	1623	.616	.021	1546	.647	.021	1532	.653
150	47	294.00	25½	35.27	.022	1082	.924	.025	1031	.970	.025	1037	.964
3	48	4.62	43	2248.33	.0030	68333	.0146	.0030	65567	.0153	.0050	43938	.0228
4	48	6.16	42	1686.25	.0030	51250	.0195	.0035	49175	.0203	.0055	34901	.0287
5	48	7.70	41	1349.00	.0035	41000	.0244	.0040	39340	.0254	.0060	29561	.0338
6	48	9.24	40	1124.16	.0040	34167	.0293	.0045	32783	.0305	.0060	26069	.0384
7	48	10.78	39½	963.57	.0045	29286	.0341	.0045	28100	.0356	.0065	22989	.0435
8	48	12.32	39	843.13	.0045	25625	.0390	.0050	24588	.0407	.0070	20525	.0487
9	48	13.86	38½	749.44	.0050	22778	.0439	.0055	21856	.0458	.0070	18564	.0539
10	48	15.40	38	674.50	.0050	20500	.0488	.0060	19670	.0508	.0075	16892	.0592
15	48	23.10	36½	449.66	.0065	13667	.0732	.0070	13113	.0763	.0085	11685	.0856
20	48	30.80	35	337.25	.0070	10250	.0976	.0080	9835	.102	.0095	8969	.111
25	48	38.50	34	269.80	.0080	8200	.122	.0090	7868	.127	.010	7282	.137
30	48	46.20	33½	224.83	.0090	6833	.146	.010	6557	.153	.011	6136	.163
40	48	61.60	32	168.63	.010	5125	.195	.011	4918	.203	.012	4659	.215
50	48	77.00	31	134.90	.011	4100	.244	.013	3934	.254	.014	3760	.266
60	48	92.40	30½	112.42	.013	3417	.293	.014	3278	.305	.015	3157	.317
75	48	115.50	29½	89.93	.014	2733	.366	.016	2623	.381	.016	2547	.393
100	48	154.00	28	67.45	.016	2050	.488	.018	1967	.508	.018	1923	.520
125	48	192.50	27	53.96	.018	1640	.610	.020	1574	.635	.020	1548	.646
150	48	231.00	26½	44.96	.020	1367	.732	.022	1311	.763	.022	1297	.771
175	48	269.50	25½	38.54	.021	1171	.854	.024	1124	.890	.024	1118	.894

Laboratory Services

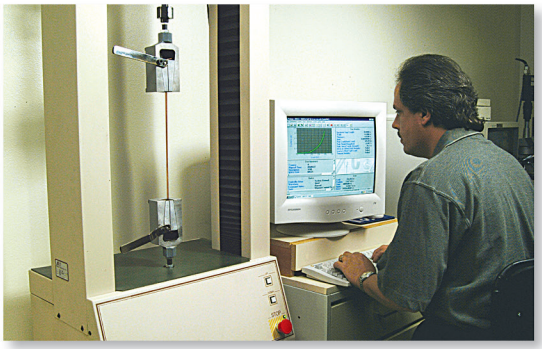
Consistent product quality is an essential requirement for our wire users. MWS maintains one of the most comprehensive wire testing facilities in the specialty wire industry, capable of testing per NEMA MW 1000 for insulated copper and aluminum magnet wire. MWS is a qualified UL producer to OBWM2, Magnet wire component, File # E211068. MWS is an ISO 9001:2008 registered company.

Testing capabilities include:

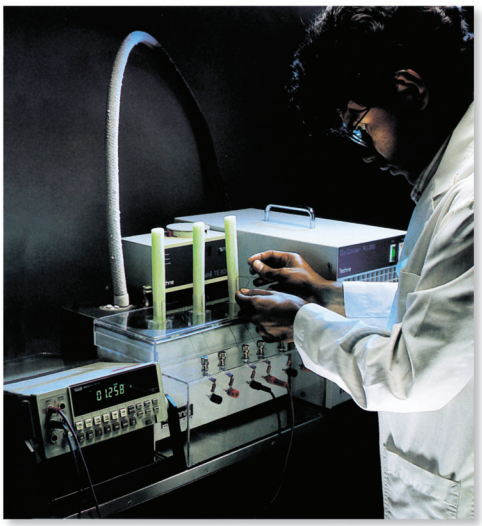
Dimensional Analysis	Contact and non-contact laser micrometer analysis, and cross-section optical measurements for concentricity and corner radius measurements.
Mechanical Properties	Stress/strain analysis; tensile, yield, break strength values.
Electrical Properties	DC resistance, dielectric strength, capacitance, impedance, continuity of insulation, completeness of insulation cure, and TCR measurements.
Thermal Properties	Thermoplastic flow, heat shock, insulation adherence, thermal endurance, and solderability of insulations per NEMA MW 1000.
Material Analysis	Base metal chemical analysis accurate to 1ppm. Insulated material analysis performed using infrared spectroanalysis.
Special Testing	To customer specification, custom-built test equipment for unique applications.



The Olympus Stereo Microscope, together with the Boeckeler Measurement and Sony Imaging System, can take cross-sectional measurements as small as 3 microns. Measurements include X-axis / Y-axis measurements as well as corner radius. Verification can then be sent to our customers by either a printed color photograph or digital image sent via e-mail.

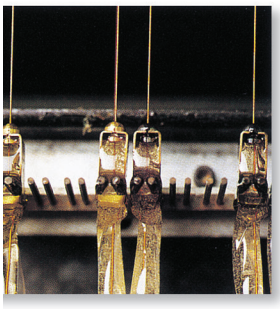


The Satec Model T1000, incorporated with Satec's "Partner" software, provides precise values for the physical and mechanical properties of metals. Specific tensile strength, break load (from 2 grams to 1,000 pounds), yield strength, elongation and bond strength data is obtained on a wide range of bare and insulated wire and ribbon. Reports can be generated and sent to our customers for test value verification.



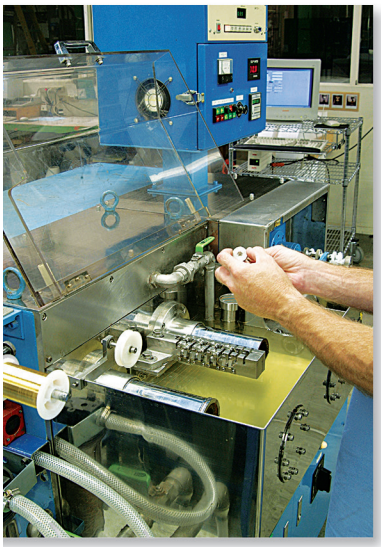
This Techne temperature-controlled bath provides MWS the capability to perform temperature coefficient of resistance (TCR) measurements for a variety of specialty metals and alloys. Precise resistance values can be obtained between -0°C and 100°C.

The Associated Research Model 7550DT Hi-pot/Dielectric tester has a testing range of 0 to 5,000 volts AC and 6,000 volts DC. The Hipotronics Model M 120 TT dielectric tester (shown right) has a range of 20,000 volts AC.



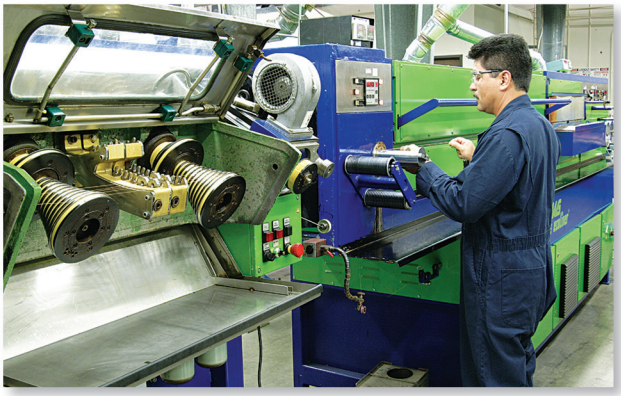
Metering dies are used to apply smooth, concentric film coats to wires sizes AWG 30 and heavier.

MWS produces custom round, square, rectangular, ribbon, Multifilar®, Twistite™ and Microsquare™ wires in a well-equipped, fully permitted manufacturing facility. Products offered include film insulated wire conforming to NEMA MW 1000 and IEC 60317 in temperature classes 105 to 240°C, from single through quadruple film builds. Low minimums, quick deliveries and top quality are our standards.

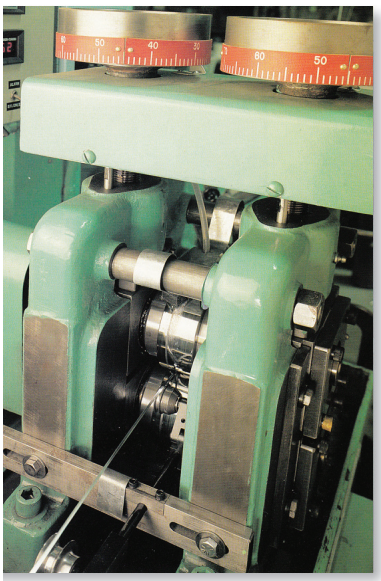


This specially designed machine draws precious metals to ultra-fine sizes in standard and custom diameters and tempers.

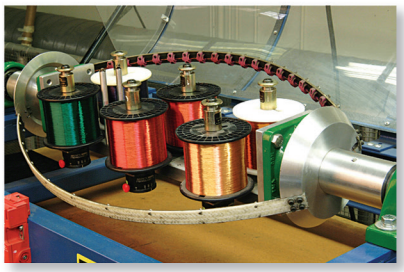
A MAG vertical oven enamel coats round, square and rectangular wire and is suitable for both small quantity and high production runs.



In-line drawing machines can be utilized on any enameling oven, enabling production efficiencies as well as excellent bare wire quality.



Reusch Model#154 Rolling mil provides state-of-the-art capabilities for production of tight tolerance flat conductors. Sizes range from .0005" thickness to 2" widths with tolerances as close as +.00015".



Twistite™ magnet wire, up to 50 twists per inch, is produced for numerous electronic applications, utilizing a wide range of conductor materials, insulations and colors.

Continuous in-line diameter measurement provides effective quality assurance on high speed enameling lines. The data can be converted into reports that record the minimum, maximum and average dimensions, and the process capability for a given production run.

Properties of Major Alloys

MATERIAL	CHEMICAL COMPOSITION (%)	RESISTIVITY AT 20°C		COEFFICIENT OF LINEAR EXPANSION BETWEEN 20-100°C	TENSILE STRENGTH (PSI AT 20C)		SPECIFIC GRAVITY	POUNDS PER CUBIC INCH	MAGNETIC ATTRACTION	APPROX. MELTING POINT (°C)
		OHMS/ CMF	TCR 0-100°C		MIN.	MAX.				
MWS-875	22.5 Cr, 5.5 Al, .5 Si, .1 C, bal. Fe	875	.00002	.000012	105,000	175,000	7.10	.256	Strong	1520
MWS-800	75 Ni, 20 Cr, 2.5 Al, 2.5 Cu	800	.00002	.000014	100,000	200,000	8.10	.293	None	1350
MWS-675	61 Ni, 15 Cr, bal. Fe	675	.00013	.0000137	95,000	175,000	8.247	.2979	Faint	1350
MWS-650	80 Ni, 20 Cr	650	.00010	.0000132	100,000	200,000	8.412	.3039	None	1400
ALLOY 42	42 Ni, bal. Fe	390	.0010	.0000029	70,000	150,000	8.10	.295	Strong	1425
MWS-294	55 Cu, 45 Ni	294	.00002*	.0000149	60,000	135,000	8.90	.321	None	1210
MWS-294R	29 Ni, 17 Co, bal. Fe	294	.0033	.0000033	65,000	150,000	8.36	.302	Strong	1450
Manganin	13 Mn, 4 Ni, bal. Cu	290	.000015**	.0000187	40,000	90,000	8.192	.296	None	1020
ALLOY 52	50.5 Ni, bal. Fe	260	.0029	.0000049	70,000	150,000	8.25	.301	Strong	1425
MWS-180	23 Ni., bal. Cu	180	.00018	.0000159	50,000	100,000	8.90	.321	None	1100
MWS-120	70 Ni, 30 Fe	120	.0045	.000015	70,000	150,000	8.46	.305	Strong	1425
MWS-90	12 Ni, bal. Cu	90	.0004	.0000161	35,000	75,000	8.90	.321	None	1100
MWS-60	6 Ni, bal. Cu	60	.0005	.0000163	35,000	70,000	8.90	.321	None	1100
MWS-30	2 Ni, bal. Cu	30	.0013	.0000165	30,000	60,000	8.90	.321	None	1100
Nickel 205	99 Ni	57	.0048	.000013	60,000	135,000	8.90	.321	Strong	1450
Nickel 270	99.97 Ni	45	.0067	.000013	48,000	95,000	8.89	.321	Strong	1452

*TCR at 25-105°C
**TCR at 15-35°C
Note: Available bare or insulated. See pages 2 and 3 for available insulations.

Trade Name Cross Reference

MWS WIRE IND.	CARPENTER TECH.	DRIVER-HARRIS	HARRISON	HOSKINS	JELLIFF	KANTHAL	MOLECU
MWS-875	Alchrome 875		HAI-FeCr Al 25	Alloy 875		Kanthal A-I	
MWS-800	Evanohm	Karma	HAI-431	Chromel R	Alloy 800	Nikrothal L	Moleculoy
MWS-675	Tophet C	Nichrome	HAI-NiCr 60	Chromel C	Alloy C	Nikrothal 6	Electroloy
MWS-650	Tophet A	Nichrome V	HAI-NiCr 80	Chromel A	Alloy A	Nikrothal 8	Protoloy
MWS-294	Cupron	Advance	HAI-CuNi 102	Copel	Alloy 45	Cuprothal 294	Neutroloy
MWS-294R	Kovar		HAI-373				
MWS-180	180 Alloy	Midohm	HAI-180	Alloy 380	Alloy 180	Cuprothal 180	
MWS-120	Balco	Hytemco	HAI-380		Alloy 120		Pelcoloy
MWS-90	90 Alloy	#95 Alloy	HAI-90	Alloy 290	Alloy 90	Cuprothal 90	
MWS-60	60 Alloy	Lohm	HAI-60	Alloy 260	Alloy 60	Cuprothal 60	
MWS-30	30 Alloy	#30 Alloy	HAI-30	Alloy 230	Alloy 30	Cuprothal 30	

Major Alloy Resistance Data

SIZE (AWG)	DIA. (INCHES)	NOMINAL OHMS PER LINEAR FOOT AT 20°C												
		NI 270*	NI 205	MWS-875	MWS-800	MWS-675	MWS-650	MANGANIN	MWS-294	ALLOY 180	MWS-120	ALLOY 90	ALLOY 60	ALLOY 30
4	.204	.001081	.001442	.02103	—	.01622	.01562	.006968	.0070	—	.002884	—	—	—
5	.182	.001358	.001811	.02642	—	.02038	.01962	.008755	.0088	—	.003622	—	—	—
6	.162	.001715	.002286	.03334	—	.02572	.02476	.01105	.0112	—	.004572	—	—	—
7	.144	.002170	.002894	.04220	—	.03255	.03135	.01399	.0142	—	.005788	—	—	—
8	.128	.002747	.003662	.05341	—	.04120	.03967	.01770	.0180	.01099	.007324	.00549	.003662	.00183
9	.114	.003463	.004617	.06733	—	.05194	.05001	.02231	.0226	.01385	.009234	.006925	.004617	.00230
10	.102	.004325	.005767	.08410	—	.06488	.06248	.02787	.0283	.01730	.01153	.00865	.005767	.00288
11	.091	.005434	.007246	.10566	—	.08151	.07849	.03502	.0355	.02174	.01449	.01082	.007246	.00362
12	.081	.006859	.009145	.13336	—	.1029	.09907	.04420	.0448	.02744	.01829	.01372	.009145	.00457
13	.072	.008681	.01157	.1688	—	.1302	.1254	.05594	.0567	.03471	.02314	.01735	.01157	.00578
14	.064	.010986	.01465	.2136	—	.1684	.1587	.07080	.0717	.04395	.02930	.02194	.01465	.00732
15	.057	.013850	.01847	.2693	.2462	.2078	.2000	.08926	.0905	.05541	.03694	.02770	.01847	.00923
16	.051	.017301	.02307	.3364	.3076	.2595	.2499	.1115	.1130	.06921	.04614	.03460	.02307	.01153
17	.045	.022222	.02963	.4321	.3951	.3333	.3209	.1432	.1452	.08889	.05926	.04444	.02963	.01482
18	.040	.028125	.03750	.5469	.5000	.4219	.4062	.1813	.1837	.1125	.0750	.0562	.03750	.01825
19	.036	.034722	.04630	.6752	.6173	.5208	.5015	.2238	.2268	.1389	.0926	.06945	.04630	.02315
20	.032	.043945	.05859	.8545	.7813	.6592	.6347	.2832	.2871	.1758	.1171	.0879	.05859	.02924
21	.0285	.055400	.07387	1.077	.9849	.831	.8002	.3570	.3619	.2216	.1477	.1108	.07387	.03693
22	.0253	.07030	.09374	1.367	1.250	1.055	1.017	.4531	.4590	.2812	.1860	.1406	.09374	.04687
23	.0226	.08810	.1175	1.713	1.566	1.322	1.272	.5678	.5756	.3525	.2350	.1762	.1175	.05875
24	.0201	.11138	.1485	2.166	1.980	1.671	1.609	.7178	.7280	.4455	.2970	.2227	.1485	.07425
25	.0179	.14044	.1873	2.731	2.497	2.107	2.029	.9051	.9176	.5619	.3746	.2809	.1873	.09365
26	.0159	.1780	.2373	3.461	3.164	2.670	2.571	1.147	1.163	.7119	.4746	.3554	.2373	.11865
27	.0142	.2232	.2976	4.339	3.967	3.348	3.228	1.438	1.458	.8928	.5952	.4464	.2976	.14880
28	.0126	.2834	.3778	5.511	5.039	4.251	4.090	1.826	1.852	1.133	.7556	.5665	.3778	.18890
29	.0113	.3524	.4699	6.853	6.265	5.286	5.090	2.271	2.302	1.401	.9398	.7001	.4669	.23494
30	.0100	.4500	.6000	8.750	8.00	6.750	6.500	2.900	2.940	1.800	1.200	.9000	.6000	.30000
31	.0089	.5681	.7576	11.047	10.10	8.523	8.206	3.662	3.710	2.273	1.515	1.1365	.7576	.37830
32	.0080	.7031	.9375	13.672	12.50	10.55	10.16	4.531	4.594	2.813	1.875	1.4065	.9375	.46875
33	.0071	.8927	1.190	17.358	15.87	13.39	12.90	5.754	5.833	3.572	2.380	1.786	1.1905	.59525
34	.0063	1.1338	1.511	22.046	20.16	17.00	16.37	7.305	7.408	4.534	3.022	2.267	1.5113	.75565
35	.0056	1.4349	1.913	27.902	25.51	21.52	20.72	9.247	9.375	5.740	3.826	2.870	1.9132	.9566
36	.0050	1.8000	2.400	35.000	32.00	27.00	26.00	11.60	11.76	7.200	4.800	3.600	2.400	1.2000
37	.0045	2.2222	2.963	43.210	39.51	33.33	32.09	14.32	14.52	8.889	5.926	4.444	2.963	1.4815
38	.0040	2.8125	3.750	54.688	50.00	42.19	40.62	18.13	18.37	11.25	7.500	5.625	3.750	1.8750
39	.0035	3.6735	4.898	71.429	65.31	55.10	53.06	23.67	24.00	14.69	9.796	7.345	4.898	2.4490
40	.0031	4.6826	6.243	91.051	83.25	70.24	67.63	30.18	30.59	18.72	12.49	9.360	6.240	3.1200
—	.00275	5.9504	7.937	115.702	105.8	89.29	85.98	38.36	38.87	233.97	15.86	11.985	7.937	3.9635
—	.0025	7.2000	9.600	140.000	128.0	108.0	104.00	46.40	47.04	28.80	19.20	14.400	9.60	4.800
—	.00225	8.8889	11.85	172.840	158.0	133.4	128.5	57.31	58.07	35.58	23.70	17.790	11.86	5.930
—	.0020	11.2500	15.00	218.750	200.0	168.8	162.5	72.50	73.50	45.00	30.00	22.500	15.00	7.500
—	.00175	14.6939	19.59	285.714	261.3	220.6	212.4	94.69	96.00	58.83	39.18	29.915	19.61	9.805
—	.0015	20.0000	26.66	388.889	355.6	300.0	288.9	128.9	130.66	—	53.33	—	—	—
—	.0014	22.9592	—	446.429	408.2	344.4	331.6	148.0	150.00	—	61.22	—	—	—
—	.0013	26.6272	—	517.752	473.4	399.6	384.6	171.6	174.00	—	71.01	—	—	—
—	.0012	31.2500	—	607.639	555.0	468.7	451.4	201.4	204.00	—	83.33	—	—	—
—	.0011	37.1901	—	723.140	661.2	557.8	537.2	239.7	243.00	—	99.17	—	—	—
—	.0010	45.0000	—	875.000	800.0	675.0	650.0	290.0	294.0	—	120.0	—	—	—
—	.0009	55.5556	—	1080.247	987.7	833.3	802.0	—	—	—	—	—	—	—
—	.0008	70.3125	—	1367.188	1250.0	1054.6	1016.0	—	—	—	—	—	—	—
—	.0007	91.8367	—	1785.714	1633.0	1377.5	1327.0	—	—	—	—	—	—	—
—	.0006	125.0000	—	2430.556	2222.0	1875.0	1806.0	—	—	—	—	—	—	—
—	.0005	180.0000	—	3500.000	3200.0	2700.0	2600.0	—	—	—	—	—	—	—

*Using 45 OHMS/CMF

Plated Wire and Ribbon

MWS produces and inventories the most complete line of continuous electroplated wires and ribbons to be found anywhere in the world. These wires are produced to meet customers' most critical solderability, purity, and dimensional requirements, as well as a variety of federal, military and commercial standards and specifications.

Plating Finishes
Gold, Silver, Nickel, Tin, Tin/Lead (60/40, 70/30, 90/10), Cadmium

Surface Conditions and Treatments
Bright, semi-bright, or matte finish

Conductor Materials
Copper, Nickel, Kovar, Dumet, Copper-Nickel Alloys, Nickel-Iron Alloys, Nickel-Chromium Alloys, Beryllium Copper, Phosphor Bronze, and Brass, along with a variety of other metals and alloys.

Bus Wire
Commercial tin-plated copper wire is available in sizes 8 - 40 AWG.

Size Range Capabilities
Round: .125" - .0007"
Flat/square/rectangular: thickness .0005" and larger, widths up to .125"

Packaging
Continuous lengths on spools or cut and straightened to specific lengths per customer requirements

Plated Copper Wire Data

SIZE (AWG)	DIAMETER (INCHES)	CIRCULAR MILS	RESISTANCE (OHMS PER 1000 FT. AT 20°C)	POUNDS PER 1000 FT.	THICKNESS OF COATING (MICROINCHES)											
					SILVER PLATED							NICKEL PLATED				
	NOMINAL	NOMINAL	NOMINAL		1.25%	2%	2.5%	3%	4%	5%	6.1%	2%	4%	7%	10%	27%
14	.0641	4110	2.48	12.4	170	272	343	417	551	692	846	322	647	1142	1645	4670
15	.0571	3260	3.13	9.87	151	243	305	371	491	617	754	282	577	1018	1465	4160
16	.0508	2580	3.95	7.81	135	216	272	330	437	549	671	255	513	905	1304	3700
17	.0453	2050	4.98	6.21	120	193	242	294	390	489	598	228	458	807	1162	3300
18	.0403	1620	6.30	4.92	107	171	216	262	347	435	532	202	407	718	1034	2930
19	.0359	1290	7.91	3.90	95	153	192	233	309	388	474	180	363	640	921	2610
20	.0320	1020	10.0	3.10	85	136	171	208	247	346	422	161	323	570	821	2330
21	.0285	812	12.6	2.46	76	121	152	185	245	308	376	143	288	508	731	2070
22	.0253	640	15.9	1.94	67	108	135	164	218	273	334	127	255	451	649	1850
23	.0226	511	20.0	1.55	60	96	121	147	194	244	293	114	228	403	580	1640
24	.0201	404	25.2	1.22	53	85	108	131	173	217	265	101	203	358	516	1460
25	.0179	320	31.9	.970	47	76	96	116	154	193	236	90	181	319	459	1300
26	.0159	253	40.3	.765	42	68	85	103	137	172	210	80	161	283	408	1160
27	.0142	202	50.5	.610	38	60	76	92	122	153	187	71	143	253	364	1030
28	.0126	159	64.2	.481	33	54	67	82	108	136	166	63	127	224	323	920
29	.0113	128	79.7	.387	30	48	60	73	97	122	149	57	114	201	290	820
30	.0100	100	102	.303	27	43	54	65	86	108	132	50	101	178	256	730
31	.0089	79.2	129	.240	24	38	48	58	77	96	117	45	90	159	228	650
32	.0080	64.0	159	.194	21	34	43	52	69	86	106	40	81	143	205	580
33	.0071	50.4	202	.153	19	30	38	46	61	77	94	36	72	126	182	520
34	.0063	39.7	257	.120	17	27	34	41	54	68	83	32	64	112	162	460
35	.0056	31.4	325	.0949	15	24	30	36	48	60	74	28	57	100	144	410
36	.0050	25.0	408	.0757	13	21	27	33	43	54	66	25	50	89	128	360
37	.0045	20.2	505	.0613	12	19	24	29	39	48	59	23	45	80	116	320
38	.0040	16.0	638	.0484	11	17	21	26	34	43	53	20	40	71	103	290
39	.0035	12.2	836	.0371	9	15	19	23	30	38	46	18	35	62	90	260
40	.0031	9.61	1061	.0291	8	13	17	20	27	33	41	16	31	55	80	230

MWS inventories bare pure gold, silver and platinum from AWG 16 and finer, in addition to ribbon and flat wire. These precious metals can also be insulated and produced in Multifilar®, Microsquare™ and Twistite™ constructions. Refractory metals, tungsten and niobium, are available from stock at .020" and finer.

Properties of Specialty Metals

METAL	ATOMIC SYMBOL	MELTING POINT (°C)	DENSITY (lbs./in.^{3})	COEFFICIENT of LINEAR THERMAL EXPANSION @ 20°C (x 10-6/K)	THERMAL CONDUCTIVITY @ 0°C (W/(m x K))	ELECTRICAL RESISTIVITY @ 20°C (Ω/circ. mil/foot)	TEMPERATURE COEFFICIENT of RESISTANCE (0-100°C)	ANNEALED TENSILE STRENGTH (ksi)
Gold	Au	1064	.698	14.2	317	13.31	.00372	30-32
Niobium	Nb	2468	.310	7.2	52	78.80	.0026	30-40
Platinum	Pt	1769	.775	8.9	71	63.91	.00393	18-24
Silver	Ag	962	.379	18.9	418	9.56	.00382	18-27
Tungsten	W	3410	.695	4.5	173	33.08	.0046	350-450

Ribbon and Flat Products

Precious metal rolling mill custom-built and specifically designed for fabrication of gold, silver, and platinum ribbon. Dimensional tolerances as tight as .00015".

MWS supplies three basic types of flat conductors: ribbon (flat wire), strip, and foil or sheet. All three products are produced in a series of rolling processes, and are supplied with round, radial, or sharp-edge constructions.

Ribbon
Normally produced from round wire in a single or multiple pass rolling process, ribbon products range in size from thicknesses as small as .0005", and widths as large as .100". Thickness tolerances are as tight as ±.00015", and width tolerances are as tight as ±.0005". Ribbon products usually are supplied with rounded edges, on spools that are paper sectioned to enhance despooling.

Strip
Generally speaking, strip products range from thicknesses of .005", with widths from .125" to 2". Radial or sharp edges are available, with material packaged in coils or on spools.

Foil or Sheet
Produced after rolling, by a shearing or slitting process, foil or sheet is supplied in widths from 2" to 12". Thicknesses can range from .001" to .020". The slit edge is sharp and may require deburring for certain applications.

Properties of Copper and Copper Alloys

CDA ALLOY NO.	ALLOY NAME	CHEMICAL COMPOSITION (%)		DENSITY (LB/CU IN)	ELECTRICAL CONDUCTIVITY (%IACS @ 68°F)	RESISTIVITY (OHMS-CIRC. MIL/FT)	APPROXIMATE MELTING POINT (°F)	MECHANICAL PROPERTIES					
								TENSILE STRENGTH (KPSI)		YIELD STRENGTH (KPSI)		ELONGATION (%)	
		Cu	OTHER					HARD	SOFT	HARD	SOFT	HARD	SOFT
C10100	Certified OFHC Copper	99.99 Min.	—	.323	101	10.3	1981	55	34	50	11	6	36
C10200	OFHC Copper	99.95 Min.	—	.323	101	10.3	1981	55	34	50	11	6	36
C11000	ETP Copper	99.90 Min.	O .04	.323	100	10.3	1949	55	34	50	12	5	36
C15000	Zirconium Copper	99.85	Zr .15	.321	93	11.2	1796	64	30	62	13	1.5	30
C17200	Beryllium Copper	98.1	Be 1.9	.298	22	46.2	1590	152	68	125	28	1	42
C26000	Cartridge Brass	70	Zn 30	.308	28	37.0	1680	109	52	68	21	5	30
C51000	Phosphor Bronze	94.8	Sn 5.0 P .2	.320	15	69.1	1750	110	51	85	21	5	49

Properties are nominal values, and should not be used for specification purposes.
Elongation values are generally size dependent.

Certified OFHC Copper (CDA C10100)
This is an unalloyed, high purity copper that has excellent forming and brazing characteristics, as well as resistance to hydrogen embrittlement at elevated temperatures. It has good solderability and corrosion resistance, and may be used in any high current application. Both grades of OFHC copper are available in round and shaped wire and may be substituted for ETP copper wherever optimal properties of copper are desired.

OFHC Copper (CDA C10200)
OFHC copper has 99.95% minimum copper (silver counted as copper) and is produced by converting cathodes in a continuous casting and rolling process into copper rod. Typical uses include bus bars or any electrical conductor, and it may be specified as a special magnet wire conductor.

ETP Copper (CDA C11000)
Electrolytic tough pitch copper is intentionally alloyed with oxygen to achieve the best combination of conductivity, capacity for being cold worked, and economy. This is the most widely used copper for wire conductors and is available in round, square and rectangular shapes.

Zirconium Copper (CDA C15000)
This copper alloy exhibits high conductivity, excellent solderability, and good strength. Unlike ETP and the OFHC coppers, zirconium copper resists softening at higher temperatures. Typical applications include switches, high current interconnects, terminal pins, welding tips, and other applications where high temperatures exist.

Beryllium Copper (CDA C17200)
This alloy is characterized by very high strength and good electrical conductivity. Normally supplied in age-hardenable tempers, beryllium copper has good to excellent cold workability. This alloy is available as bare wire or it can be film insulated. Typical uses include switch parts, springs, fuse clips, connectors, and contacts.

Cartridge Brass (CDA C26000)
Cartridge brass has good conductivity and strength, but poor solderability due to its high zinc content. This copper alloy is widely used for cold-headed products such as machine and wood screws, rivets, and fasteners. It may also be used as an economical spring material.

Phosphor Bronze (CDA C51000)
This alloy is widely used for most types of springs because of its high strength and resistance to corrosion and fatigue. It is also used in switches, relays, contacts, and fasteners.

EC Aluminum Wire Data

Aluminum 1350, also referred to as EC (electrical conductor) aluminum, is the primary alloy utilized in aluminum magnet wire. Its combination of light weight, high thermal conductivity, and high mass electrical conductivity (more than twice that of copper, per pound), make it an ideal alternative to copper for certain winding applications. Most film insulations are available on round aluminum wire. For insulation data, see pages 2 and 3. For square aluminum wire data, see page 7.

SIZE (AWG)	DIAMETER (INCHES)			RESISTANCE (OHMS PER 1000 FT. AT 20°C)			FEET PER POUND	POUNDS PER 1000 FT.	CIRCULAR MILS NOMINAL	SIZE (AWG)
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.				
10	.1009	.1019	.1029	1.58	1.611	1.643	104	9.56	10380	10
11	.0898	.0907	.0916	1.99	2.03	2.07	132	7.57	8230	11
12	.0800	.0808	.0816	2.51	2.56	2.61	166	6.01	6530	12
13	.0713	.0720	.0727	3.17	3.23	3.29	210	4.77	5190	13
14	.0635	.0641	.0647	4.00	4.07	4.15	264	3.78	4110	14
15	.0565	.0571	.0577	5.02	5.13	5.24	333	3.00	3260	15
16	.0503	.0508	.0513	6.36	6.48	6.61	421	2.38	2580	16
17	.0448	.0453	.0458	7.97	8.15	8.33	529	1.89	2050	17
18	.0399	.0403	.0407	10.1	10.3	10.5	669	1.49	1620	18
19	.0355	.0359	.0363	12.7	13.0	13.3	843	1.19	1290	19
20	.0317	.0320	.0323	16.0	16.3	16.6	1060	.942	1020	20
21	.0282	.0285	.0288	20.2	20.6	21.0	1340	.748	812	21
22	.0250	.0253	.0256	25.5	26.1	26.8	1700	.589	640	22
23	.0224	.0226	.0228	32.2	32.8	33.3	2130	.470	510	23
24	.0199	.0201	.0203	40.6	41.4	42.2	2690	.372	404	24
25	.0177	.0179	.0181	51.1	52.2	53.4	3390	.295	320	25
26	.0157	.0159	.0161	64.5	66.2	67.9	4300	.233	253	26
27	.0141	.0142	.0143	81.8	83.0	84.1	5390	.186	202	27
28	.0125	.0126	.0127	103.7	105.3	107.0	6845	.1461	158.8	28
29	.0112	.0113	.0114	128.7	131.0	133.4	8503	.1176	127.7	29
30	.0099	.0100	.0101	164.0	167.3	170.7	10870	.0920	100.0	30
31	.0088	.0089	.0090	206.5	211.2	216.0	13717	.0729	79.21	31
32	.0079	.0080	.0081	255.0	261.4	268.0	16978	.0589	64.00	32
33	.0070	.0071	.0072	322.7	331.8	341.4	21552	.0464	50.41	33
34	.0062	.0063	.0064	408.4	421.5	435.2	27397	.0365	39.69	34
35	.0055	.0056	.0057	514.9	533.4	553.0	34602	.0289	31.36	35
36	.0049	.0050	.0051	643.1	669.1	696.7	43478	.0230	25.00	36

Properties of Aluminum Alloys

Aluminum's unique combination of properties make it a highly versatile material when alloyed with various metals. Besides light weight, characteristics of aluminum alloys include excellent workability and inherent corrosion resistance due to the inert oxide coat that forms directly after exposure to air. Many alloys in the 1000 through 5000 series are non-heat-treatable, their strength depending on the amount of cold working done. In the case of 5056 alloy, the addition of magnesium as the principal alloying agent increases its initial tensile strength. Alloy 6061 is a heat-treatable alloy supplied in annealed or strain hardened tempers. The end user may achieve maximum tensile strength through a multi-step thermal treatment.

ALLOY	CHEMICAL COMPOSITION (%)	ULTIMATE TENSILE STRENGTH (PSI)	ELECTRICAL CONDUCTIVITY IACS (68°F)	ELECTRICAL RESISTIVITY (OHMS-CIRC. MIL/FT)	DENSITY (LB/CU IN)	SPECIFIC GRAVITY	COEFFICIENT OF THERMAL EXPANSION X 10^{-6} (68 - 212°F)	APPROX. MELTING POINT (°F)
1350(EC)	99.5 Al min.	13,000	61.8	17	.098	2.7	23.8	1200
1100	.12 Cu, 99 Al min.	13,000	59	18	.098	2.71	23.6	1195
1199	99.996 Al min.	6,800	64.9	15	.0975	2.7	23.6	1220
5056	.12 Mn, 5 Mg, .12 Cr, Al bal.	42,000	29	36	.095	2.64	24.1	1060
6061	.6 Si, .28 Cu, 1 Mg, .2 Cr, Al bal.	17,000	47	22	.098	2.7	23.6	1080

Mechanical and electrical values based on annealed temper.

Mechanical Alloys

When selecting wire for mechanical applications there are four classifications from which to choose a specific material or alloy. They are: nickel base lockwires, carbon steels, stainless steels and superalloys. A three-part evaluation procedure is recommended: 1) initial screening based on temperature and corrosion requirements; 2) analysis of physical properties; and 3) final screening on the basis of specific properties, material, and forming costs.

MATERIAL	COMPOSITION (%)									NOM. TENSILE STRENGTH (PSI) (SIZE RANGE: .002-.032)		MATERIAL CHARACTERISTICS
	C (MAX.)	Mn (MAX.)	Si (MAX.)	P (MAX.)	S (MAX.)	Cr	Ni	Fe	OTHERS	ANNEALED	FULL HARD (SPRING)	
#302 Stainless Steel	.15	2	1	.045	.03	17 - 19	8 - 10	Bal.	—	105,000 to 145,000	300,000 to 360,000	Most widely used stainless steel spring material due to its excellent combination of physical properties and corrosion resistance.
#304 Stainless Steel	.08	2	1	.045	.03	18 - 20	8 - 12	Bal.	—	105,000 to 145,000	300,000 to 360,000	Similar to Type 302 except for a slightly lower carbon and higher nickel content, which results in a more ductile, lower tensile alloy in the annealed condition. The major use of this alloy is in annealed and 1/4 hard wire products such as cold heading wire, weaving, or screen wire, and lockwire.
#316 Stainless Steel	.08	2	1	.045	.03	16 - 18	10 - 14	Bal.	Mo 2 - 3	95,000 to 130,000	245,000 to 275,000	Molydenum gives this material high creep strength at elevated temperatures and excellent corrosion resistance. (Generally better than Types 302, 304 and 321.) Especially resistant to pit-type corrosion.
#321 Stainless Steel	.08	2	1	.045	.03	17 - 19	9 - 12	Bal.	Ti 5 x C Min.	110,000 to 150,000	225,000 to 275,000	Good where welding is used in fabrication or where heat is encountered as a service condition. Stabilized with titanium to prevent sensitization. (Carbide precipitation and intergranular corrosion.)
17-7 PH	.09	1	1	.04	.03	16 - 18	6.5 - 7.75	Bal.	Al .75 - 1.5	—	260,000 to 295,000	Corrosion resistance comparable to Type 302 with physical properties comparable to music wire. Particularly useful where a compact, corrosion resistant spring is required. Considerably better than Type 302 for springs operating up to 600°F.
Inconel* 600	.15	1	.5	—	.015	14 -17	72 min.	6 - 10	Cu .5 max.	90,000 to 130,000	180,000 to 230,000	Resists corrosion and oxidation to 2150°F. Provides springs with high resistance to corrosion and heat up to 750°F. Tough and ductile down to -310°F; is nonmagnetic, easily fabricated and welded. Used for structural parts, cathode ray tube spiders, thyratron grids, sheathing, tube supports, spark plug electrodes.
Inconel* X-750	.08	1.2	.5	—	.01	14 -17	70 min.	5 - 9	Cu .5 max. Al .4 - 1 Ti 2.25 - 2.75 Cb .7 - 1.2	130,000 to 160,000	220,000 to 250,000	Age hardenable, nonmagnetic, corrosion and oxidation resistant; high creep-rupture strength to 1300°F. Heavy cold working develops tensile strength of 290,000 psi. Stays tough and ductile to -423°F. Resists chloride-ion stress-corrosion cracking. For springs operating to 1200°F and tube structural parts.
Monel* 400	.3	2	.5	—	.024	—	63 - 70	2.5 max.	Cu Bal.	70,000 to 95,000	145,000 to 180,000	This material is noted for its toughness over a considerable range of temperatures, and has excellent resistance to many corrosive environments. Monel 400 can be hardened only by cold-working. It is useful at temperatures up to 1050°F, and has very good mechanical properties at temperatures below zero. Melting point is 2370-2460°F.
Music Spring	1	.6	.3	.025	.03	—	—	Bal.	—	—	330,000 to 480,000	Music spring wire is high carbon steel of uniform chemical analysis. This wire is drawn within rigid tensile, smoothness, and roundness requirements and although very high in tensile strength, must be capable of wrapping around itself without showing signs of cracking or unevenness.

*Registered trademark of Inco family of companies

Clad metals are two distinct metals or alloys that are metallurgically bonded together so that the optimum combination of functional properties is achieved. Copper Clad Aluminum (CCA) is an electrical conductor with a sleeve of copper bonded to a solid aluminum core. The composite wire is uniquely suited to electrical applications where weight to conductivity issues are critical. The copper makes up either 10% or 15% of the cross sectional area of the wire and assures excellent solderability. AC conductivity at frequencies greater than 5 MHz is equal to solid copper. CCA is manufactured in accordance with the requirements of ASTM B-566. Film insulations are available on CCA wire. For insulation data, see pages 2 and 3.

Typical Physical Properties

	10%CCA	15%CCA
DC Conductivity	62.9% min IACS	64.4% min IACS
% Copper by volume	8-12%	13-17%
% Copper by weight	27% nom	34% nom
Density	.120 lb/cu in	.131 lb/cu in
Tensile strength, annealed	20-25 kPSI	20-25 kPSI
Tensile strength, hard drawn	16-30 kPSI	16-30 kPSI
Elongation, annealed	5-15% min	5-15% min
Elongation, hard drawn	1% min	1% min

(Tensile and elongation values are size dependent)

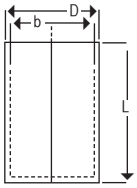
SIZE (AWG)	DIAMETER (INCHES)	AREA (CIR. MILS)	FEET PER POUND		POUNDS PER 1000 FT.		OHMS PER 1000 FT. AT 20□C		SIZE (AWG)
			10% CCA	15% CCA	10% CCA	15% CCA	10% CCA	15% CCA	
14	.0641	4109	215	197	4.64	5.06	3.91	3.79	14
15	.0571	3260	270	247	3.69	4.03	4.93	4.78	15
16	.0508	2581	342	314	2.92	3.19	6.23	6.05	16
17	.0453	2052	430	394	2.32	2.53	7.83	7.60	17
18	.0403	1624	542	497	1.84	2.01	9.90	9.61	18
19	.0359	1289	684	627	1.46	1.59	12.5	12.1	19
20	.0320	1024	862	791	1.16	1.26	15.7	15.2	20
21	.0285	812.3	1087	997	.920	1.00	19.8	19.2	21
22	.0253	640.1	1378	1264	.726	.792	25.1	24.4	22
23	.0226	510.8	1728	1585	.580	.632	31.5	30.5	23
24	.0201	404.0	2184	2004	.456	.498	39.8	38.6	24
25	.0179	320.4	2750	2524	.363	.396	50.2	48.7	25
26	.0159	252.8	3498	3210	.286	.312	63.6	61.7	26
27	.0142	201.6	4378	4018	.228	.249	79.7	77.3	27
28	.0126	158.8	5554	5096	.180	.196	101	98.2	28
29	.0113	127.7	6915	6346	.145	.158	126	122	29
30	.0100	100.0	8811	8085	.113	.124	161	156	30
31	.0089	79.21	11134	10216	.0896	.0979	203	197	31
32	.0080	64.00	13777	12642	.0726	.0792	251	244	32
33	.0071	50.41	17488	16048	.0572	.0624	319	310	33
34	.0063	39.69	22214	20384	.0449	.0490	405	390	34
35	.0056	31.36	28035	25725	.0355	.0387	513	498	35
36	.0050	25.00	35244	32340	.0283	.0309	643	624	36
37	.0045	20.25	43521	39935	.0229	.0250	794	770	37
38	.0040	16.00	55002	50470	.0181	.0196	1000	975	38
39	.0035	12.25	72090	66150	.0139	.0151	1310	1280	39
40	.0031	9.610	91848	84280	.0109	.0119	1670	1620	40

Other Clad Metals

WIRE	CORE/CLADDING	% IACS	KEY ATTRIBUTES	TYPICAL APPLICATIONS
CCS 30%	Low carbon Steel/Copper	30%	High strength, medium conductivity	Drop wire, grounding conductor
CCS 40%	Low carbon Steel/Copper	40%	High strength, medium conductivity	High strength conductors, electronic wire leads
NCC 27%	Copper/Pure Nickel	70% nom.	Combines high conductivity and oxidation resistance at elevated temperatures	High temperature electrical conductors, leadwire to heating elements
Dumet	Nickel-Iron Alloy/Copper	Approx. 17%	Thermal expansion equal to that of glass	Electronic wire leads

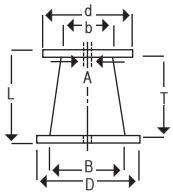
Spool Specifications

Drums



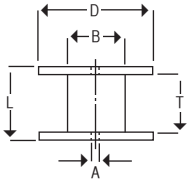
PACKAGE TYPE	FLANGE		BARREL		TRAVERSE LENGTH	OVERALL LENGTH	ARBOR HOLE DIAM.	TARE WEIGHT (POUNDS)		NOM. NET WEIGHT (POUNDS)	
	TOP (d-IN.)	BOTTOM (D-IN.)	TOP (b-IN.)	BOTTOM (B-IN.)	(T-IN.)	(L-IN)	(A-IN)	PLASTIC	FIBER/METAL	COPPER	ALUMINUM
Drum	20	20	13	13	—	30	—	—	18	550	180
½ Drum	20	20	13	13	—	15	—	—	12	250	90
Pail	11	11	7	7	—	12	—	—	3	85	30

Tapered Spools



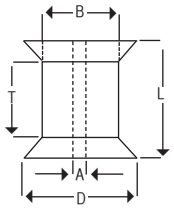
PACKAGE TYPE	FLANGE		BARREL		TRAVERSE LENGTH	OVERALL LENGTH	ARBOR HOLE DIAM.	TARE WEIGHT (POUNDS)		NOM. NET WEIGHT (POUNDS)	
	TOP (d-IN.)	BOTTOM (D-IN.)	TOP (b-IN.)	BOTTOM (B-IN.)	(T-IN.)	(L-IN)	(A-IN)	PLASTIC	FIBER/METAL	COPPER	ALUMINUM
TP1000	18¾	20½	9	10½	18 5/16	36⅞	1½	30	—	1000	300
TP500	15	16	8	9	24	26	1½	12	—	500	180
TP250	15	16	8	9	12	14	1½	10	15.0	250	90
TP100	10	11	6	7	12	13	1½	3.05	8.0	85	30
TP50	8½	9¼	5½	6½	9	10	1½	1.6	—	45	—

Straight Spools



PACKAGE TYPE	FLANGE		BARREL		TRAVERSE LENGTH	OVERALL LENGTH	ARBOR HOLE DIAM.	TARE WEIGHT (POUNDS)		NOM. NET WEIGHT (POUNDS)	
	TOP (d-IN.)	BOTTOM (D-IN.)	TOP (b-IN.)	BOTTOM (B-IN.)	(T-IN.)	(L-IN)	(A-IN)	PLASTIC	FIBER/METAL	COPPER	ALUMINUM
30”	30	30	14	14	9	12	2 1/4	—	78	850	275
24”	24	24	14	14	6	8 7/8	1 1/2	20	—	250	80
12” x 7”	12	12	6 1/2	6 1/2	7	8	1 1/2	2.8	—	85	26
12” x 4” WR	11 3/4	11 3/4	8 1/4	8 1/4	3 5/8	4	2	1.8	—	30	10
8” x 6”	8	8	4 1/2	4 1/2	5 5/8	7 1/4	3	1.5	—	30	10
6” x 6”	6	6	3 3/4	3 3/4	6	7	5/8	.95	—	12	5
6” DIN *	6 1/4	6 1/4	4	4	5	6 1/4	7/8	1.02	—	10	3
6” X 3 1/2” *	6	6	3 1/2	3 1/2	3 1/2	4 5/16	5/8	.66	—	8	3
6” X 3 1/2”	6	6	3 1/2	3 1/2	3 1/2	4	5/8	.43	—	8	3
6” RB	6	6	4	4	3	4	5/8	.64	—	8	3
4 7/8” DIN *	4 7/8	4 7/8	3 3/16	3 3/16	4	4 7/8	5/8	.55	—	6	2
5” RB	5	5	4	4	3	4	5/8	.55	—	4	1.5
4 7/8	4 7/8	4 7/8	3	3	3 1/2	4	5/8	.39	—	5	2
3”	3	3	1 3/4	1 3/4	3 1/2	4	5/8	.17	—	2	.5
3” DIN *	3 1/8	3 1/8	2	2	2 1/2	3 5/32	5/8	.15	—	1	.30
2 1/2”	2 1/2	2 1/2	1 3/4	1 3/4	3	3 3/8	5/8	.15	—	.5	.15
2 1/4”	2 1/4	2 1/4	1 3/4	1 3/4	1	1 5/16	5/8	.09	—	.20	.07

Taper Flange Spools



PACKAGE TYPE	FLANGE		BARREL		TRAVERSE LENGTH	OVERALL LENGTH	ARBOR HOLE DIAM.	TARE WEIGHT (POUNDS)		NOM. NET WEIGHT (POUNDS)	
	TOP (d-IN.)	BOTTOM (D-IN.)	TOP (b-IN.)	BOTTOM (B-IN.)	(T-IN.)	(L-IN)	(A-IN)	PLASTIC	FIBER/METAL	COPPER	ALUMINUM
10” TF	10	11	6	7	8 -11½	12½	1½	3.12	—	75	20
8” TF	8	8	4	4	3⅝ - 7⅝	8	⅞	.98	—	22	—
6” TF	6	6	3⅛	3⅛	3 - 5¼	6¼	⅝ - ⅞	.69	—	8	3
5” TF	4⅞	4⅞	2½	2½	2¼ - 4	4⅞	⅝	.35	—	5	1.75
4” TF	4	4	2	2	1⅞ - 3¾	4	⅝	.15	—	3	1
3” TF	3	3	2¾	2	2¾ - 3¾	3⅞	⅝	.19	—	1.5	.5
2½” TF	2½	2½	1¾	1¾	2⅜ - 3¼	3⅜	⅝	.16	—	.66	.15

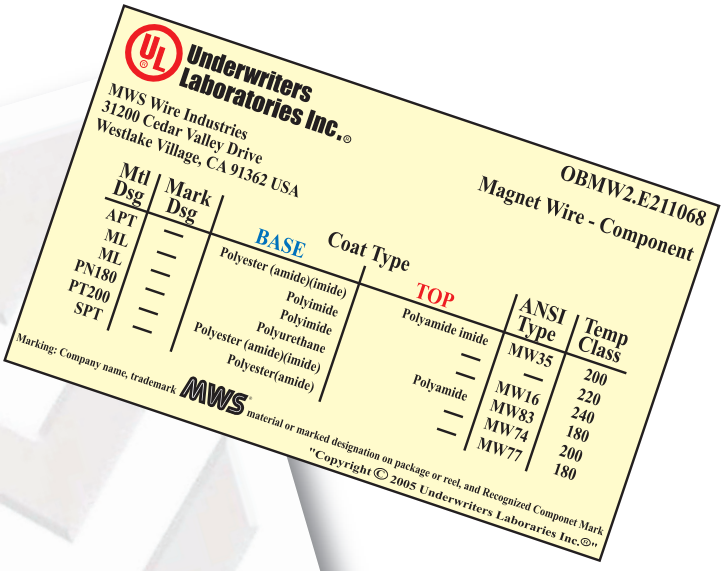
*Thick flange

Gauge to MM Conversion Chart

A.W.G			WIRE NUMBER	S.W.G.		
INCH	MM	MM²		INCH	MM	MM²
—	—	—	7/0	.5000	12,7000	126,68
—	—	—	6/0	.4640	11,7850	108,98
			5/0	.4320	10,9700	94,51
.4600	11,684	107,21	4/0	.4000	10,1600	81,07
.4096	10,404	85,03	3/0	.3720	9,4487	70,12
.3648	9,266	67,43	2/0	.3480	8,8391	61,36
.3249	8,252	53,48	1/0	.3240	8,2295	53,19
.2893	7,348	42,41	1	.3000	7,6200	45,60
.2576	6,543	33,63	2	.2760	7,0103	38,60
.2294	5,827	26,67	3	.2520	6,4008	32,18
.2043	5,189	21,15	4	.2320	5,8972	27,27
.1819	4,621	16,77	5	.2120	5,3847	22,77
.1620	4,115	13,30	6	.1920	4,8768	18,68
.1443	3,665	10,55	7	.1760	4,4703	15,70
.1285	3,264	8,37	8	.1600	4,0640	12,97
.1144	2,906	6,63	9	.1440	3,6576	10,51
.1019	2,588	5,26	10	.1280	3,2512	8,30
.0907	2,304	4,17	11	.1160	2,9463	6,82
.0808	2,052	3,30	12	.1040	2,6416	5,48
.0720	1,829	2,62	13	.0920	2,3368	4,29
.0641	1,628	2,08	14	.0800	2,0320	3,24
.0571	1,450	1,65	15	.0720	1,8288	2,63
.0508	1,291	1,31	16	.0640	1,6256	2,08
.0453	1,150	1,04	17	.0560	1,4224	1,59
.0403	1,024	0,823	18	.0480	1,2192	1,17
.0359	0,9119	0,653	19	.0400	1,0160	0,811
.0320	0,8128	0,518	20	.0360	0,9143	0,657
.0285	0,7239	0,411	21	.0320	0,8128	0,519
.0253	0,6426	0,324	22	.0280	0,7112	0,397
.0226	0,5740	0,258	23	.0240	0,6096	0,292
.0201	0,5106	0,205	24	.0220	0,5588	0,245
.0179	0,4547	0,162	25	.0200	0,5080	0,203
.0159	0,4038	0,129	26	.0180	0,4572	0,164
.0142	0,3606	0,101	27	.0164	0,4166	0,136
.0126	0,3200	0,0810	28	.0148	0,3759	0,111
.0113	0,2870	0,0644	29	.0136	0,3454	0,0937
.0100	0,2540	0,0507	30	.0124	0,3150	0,0779
.0089	0,2261	0,0403	31	.0116	0,2946	0,0682
.0080	0,2032	0,0320	32	.0108	0,2743	0,0591
.0071	0,1803	0,0254	33	.0100	0,2540	0,0507
.0063	0,1601	0,0201	34	.0092	0,2337	0,0429
.0056	0,1422	0,0160	35	.0084	0,2134	0,0358
.0050	0,1270	0,0127	36	.0076	0,1930	0,0293
.0045	0,1143	0,0100	37	.0068	0,1727	0,0234
.0040	0,1016	0,0081	38	.0060	0,1524	0,0182
.0035	0,0889	0,00618	39	.0052	0,1321	0,0137
.0031	0,0787	0,00486	40	.0048	0,1220	0,0117
.0028	0,0711	0,09397	41	.0044	0,1118	0,00981
.0025	0,0635	0,00317	42	.0040	0,1016	0,00811
.0022	0,0559	0,00245	43	.0036	0,0914	0,00657
.0020	0,0508	0,00203	44	.0032	0,0813	0,00519
.0018	0,0457	0,00164	45	.0028	0,0711	0,00397
.0016	0,0406	0,00129	46	.0024	0,0610	0,00292
.0014	0,0350	0,00109	47	.0020	0,0508	0,00203
.0012	0,0305	0,000731	48	.0016	0,0406	0,00129
.0011	0,0279	0,000611	49	.0012	0,0305	0,000731
.0010	0,0254	0,000507	50	.0010	0,0254	0,000507
.00088	0,0224	0,000394	51	—	—	—
.00078	0,0198	0,000308	52	—	—	—
.00070	0,0178	0,000249	53	—	—	—
.00062	0,0158	0,000194	54	—	—	—
.00055	0,0140	0,000154	55	—	—	—
.00049	0,0124	0,000121	56	—	—	—

MWS Wire Industries Accreditations

At MWS, the quality system has been certified to the standards of ISO 9001:2008. Our mission is to provide quality magnet wire, specialty products and unsurpassed service through a quality system focused on continuous improvement of our products, processes, and customer service.



Underwriters Laboratories Inc.®

MWS Wire Industries
31200 Cedar Valley Drive
Westlake Village, CA 91362 USA

OBMW2.E211068
Magnet Wire - Component

Mtl Dsg	Mark Dsg	BASE Coat Type	TOP	ANSI Type	Temp Class
APT	—	Polyester (amide)(imide)	Polyamide imide	MW35	200
ML	—	Polyimide	—	—	220
ML	—	Polyimide	—	MW16	240
PN180	—	Polyurethane	Polyamide	MW83	180
PT200	—	Polyester (amide)(imide)	—	MW74	200
SPT	—	Polyester(amide)	—	MW77	180

Marking: Company name, trademark, MWS material or marked designation on package or reel, and Recognized Component Mark

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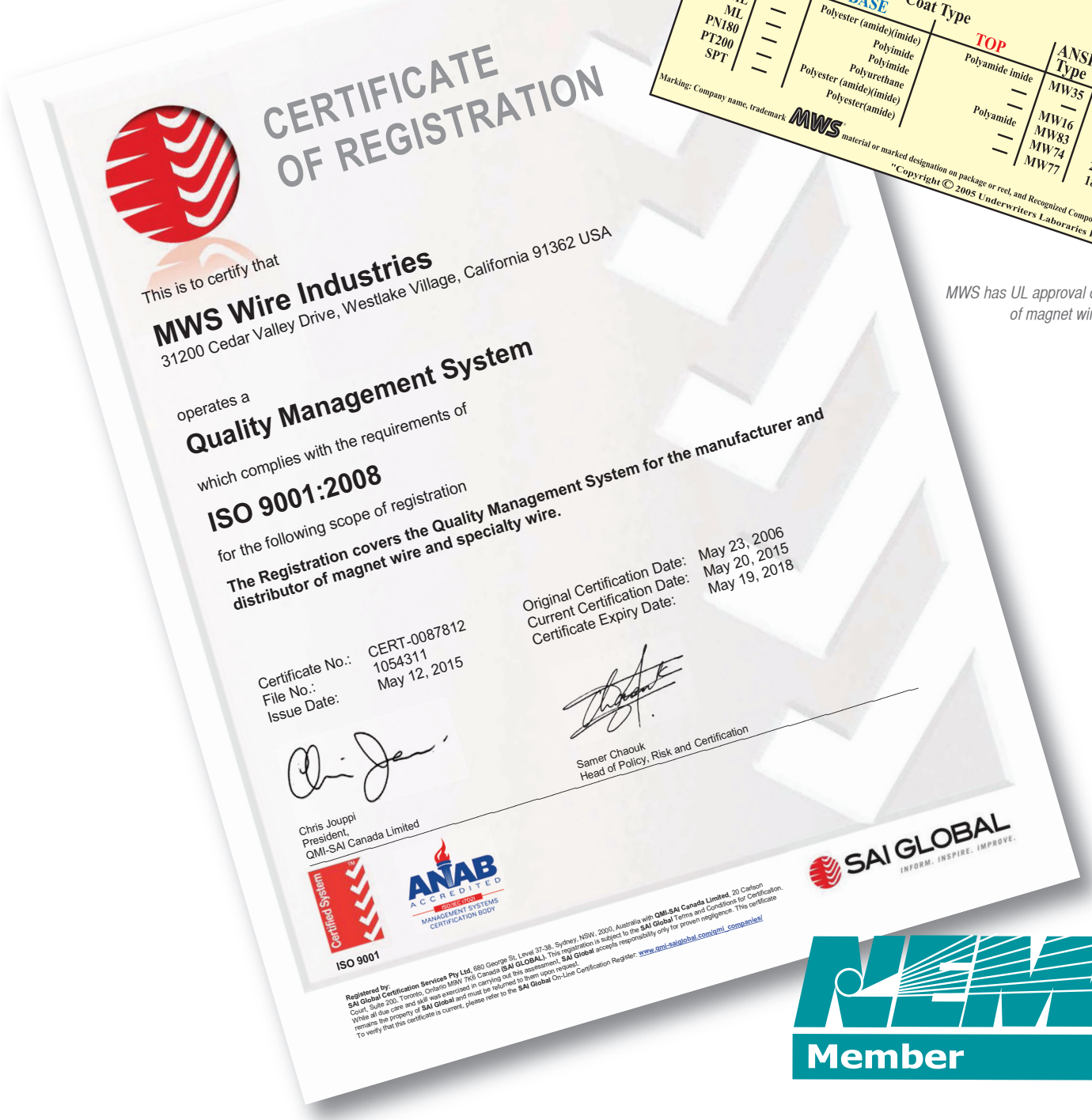
MWS has UL approval on a variety of magnet wire enamels.



CERTIFICATE OF REGISTRATION

This is to certify that

MWS Wire Industries
31200 Cedar Valley Drive, Westlake Village, California 91362 USA

operates a

Quality Management System

which complies with the requirements of

ISO 9001:2008

for the following scope of registration

The Registration covers the Quality Management System for the manufacturer and distributor of magnet wire and specialty wire.

Certificate No.: CERT-0087812
File No.: 1054311
Issue Date: May 12, 2015

Original Certification Date: May 23, 2006
Current Certification Date: May 20, 2015
Certificate Expiry Date: May 19, 2018

Chris Jouppi
President,
QMI-SAI Canada Limited

Samer Chaouk
Head of Policy, Risk and Certification

Certified System
ISO 9001

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Dimensional values derived from NEMA MW1000-1997 Standard

SIZE (AWG)	SINGLE BUILD				HEAVY BUILD				TRIPLE BUILD				QUADRUPLE BUILD				SIZE (AWG)
	DIAMETER * (INCHES)			FEET PER POUND	DIAMETER * (INCHES)			FEET PER POUND	DIAMETER * (INCHES)			FEET PER POUND	DIAMETER * (INCHES)			FEET PER POUND	
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		MIN.	NOM.	MAX.		
6	.1622	.1648	.1665	12.545	.1639	.1659	.1671	12.5	.1651	.1679	.1688	12.455	.1663	.1685	.1706	12.41	6
7	.1446	.1469	.1485	15.81	.1463	.1481	.1491	15.75	.1475	.1492	.1508	15.69	.1488	.1506	.1525	15.63	7
8	.1288	.1306	.1324	19.93	.1305	.1322	.1332	19.85	.1317	.1333	.1348	19.77	.1330	.1349	.1365	19.69	8
9	.1149	.1165	.1181	25.12	.1165	.1177	.1189	25	.1177	.1191	.1205	24.88	.1190	.1205	.1221	24.76	9
10	.1024	.1039	.1054	31.66	.1040	.1051	.1061	31.5	.1052	.1064	.1076	31.34	.1065	.1078	.1092	31.18	10
11	.0913	.0927	.0941	39.6	.0928	.0938	.0948	39	.0940	.0952	.0963	38.4	.0952	.0965	.0978	38.34	11
12	.0814	.0827	.0840	50.25	.0829	.0838	.0847	49.9	.0840	.0851	.0861	49.55	.0852	.0864	.0876	49.2	12
13	.0727	.0739	.0750	63.3	.0741	.0749	.0757	62.9	.0752	.0762	.0771	62.5	.0763	.0774	.0785	62.1	13
14	.0651	.0659	.0666	79.94	.0667	.0675	.0682	79.18	.0683	.0692	.0700	78.42	.0684	.0696	.0709	77.66	14
15	.0580	.0587	.0594	100.4	.0595	.0602	.0609	99.7	.0610	.0619	.0627	99	.0613	.0625	.0638	98.3	15
16	.0517	.0524	.0531	126.8	.0532	.0539	.0545	125.6	.0546	.0554	.0562	124.4	.0549	.0561	.0572	123.2	16
17	.0462	.0469	.0475	159.4	.0476	.0482	.0488	157.7	.0489	.0497	.0504	156	.0493	.0504	.0515	154.3	17
18	.0412	.0418	.0424	201.1	.0425	.0431	.0437	199.2	.0438	.0445	.0452	197.3	.0443	.0454	.0464	195.4	18
19	.0367	.0373	.0379	253.2	.0380	.0386	.0391	250.6	.0392	.0399	.0406	248	.0397	.0407	.0418	245.4	19
20	.0329	.0334	.0339	318.4	.0340	.0346	.0351	314.5	.0352	.0358	.0364	310.6	.0357	.0366	.0376	306.7	20
21	.0293	.0298	.0303	400.6	.0304	.0309	.0314	395.3	.0315	.0321	.0326	390	.0321	.0330	.0339	384.7	21
22	.0261	.0266	.0270	507.1	.0271	.0276	.0281	502.5	.0282	.0288	.0293	497.9	.0287	.0296	.0305	493.3	22
23	.0234	.0239	.0243	633.7	.0244	.0249	.0253	625	.0254	.0259	.0264	616.3	.0260	.0268	.0277	607.6	23
24	.0209	.0213	.0217	804.5	.0218	.0223	.0227	790.5	.0228	.0233	.0238	776.5	.0234	.0242	.0250	762.5	24
25	.0186	.0190	.0194	1010	.0195	.0199	.0203	992.1	.0204	.0209	.0214	974.2	.0211	.0219	.0226	956.3	25
26	.0166	.0170	.0173	1279	.0174	.0178	.0182	1254	.0183	.0188	.0193	1229	.0189	.0196	.0204	1204	26
27	.0149	.0153	.0156	1600	.0157	.0161	.0164	1571	.0165	.0169	.0173	1542	.0171	.0177	.0184	1513	27
28	.0133	.0137	.0140	2028	.0141	.0144	.0147	1987	.0148	.0152	.0156	1946	.0154	.0159	.0165	1905	28
29	.0119	.0123	.0126	2513	.0127	.0130	.0133	2463	.0134	.0138	.0142	2413	.0140	.0145	.0151	2363	29
30	.0106	.0109	.0112	3208	.0113	.0116	.0119	3136	.0120	.0124	.0128	3064	.0126	.0131	.0136	2992	30
31	.0094	.0097	.0100	4052	.0101	.0105	.0108	3948	.0108	.0110	.0114	3844	.0114	.0118	.0121	3740	31
32	.0085	.0088	.0091	4995	.0091	.0095	.0098	4873	.0097	.0101	.0103	4751	.0103	.0107	.0110	4629	32
33	.0075	.0078	.0081	6337	.0081	.0085	.0088	6161	.0086	.0090	.0092	5985	.0092	.0096	.0099	5809	33
34	.0067	.0070	.0072	8055	.0072	.0075	.0078	7837	.0077	.0080	.0082	7619	.0082	.0085	.0088	7401	34
35	.0059	.0062	.0064	10250	.0064	.0067	.0070	9891	.0068	.0071	.0074	9532	.0073	.0076	.0079	9173	35
36	.0053	.0056	.0058	12800	.0057	.0060	.0063	12380	.0061	.0064	.0067	11960	.0065	.0068	.0071	11540	36
37	.0047	.0050	.0052	15750	.0052	.0055	.0057	15290	.0056	.0059	.0060	14830	.0060	.0063	.0065	14370	37
38	.0042	.0045	.0047	20020	.0046	.0049	.0051	19360	.0049	.0052	.0054	18700	.0053	.0056	.0058	18040	38
39	.0036	.0039	.0041	26240	.0040	.0043	.0045	25270	.0043	.0046	.0048	24300	.0046	.0049	.0051	23330	39
40	.0032	.0035	.0037	33330	.0036	.0038	.0040	31940	.0039	.0041	.0043	30550	.0042	.0044	.0046	29160	40
41	.0029	.0031	.0033	40800	.0032	.0034	.0036	39340	.0034	.0036	.0039	37880	.0037	.0039	.0041	36420	41
42	.0026	.0028	.0030	50940	.0028	.0030	.0032	49600	.0030	.0032	.0035	48260	.0032	.0034	.0036	46920	42
43	.0023	.0025	.0026	66140	.0025	.0027	.0029	63170	.0027	.0029	.0032	60200	.0029	.0031	.0033	57230	43
44	.0020	.0022	.0024	80060	.0023	.0025	.0027	76160	.0025	.0027	.0029	72260	.0027	.0029	.0031	68360	44
45	.00179	.00192	.00205	103,500	.00199	.00215	.00230	99110	.00219	.00237	.00255	94720	.00239	.00260	.00280	90330	45
46	.00161	.00173	.00185	130,000	.00181	.00196	.00210	123,800	.00201	.00218	.00235	117,600	.00221	.00241	.00260	111,400	46
47	.00145	.00158	.00170	163,400	.00165	.00178	.00190	154,600	.00185	.00198	.00210	145,800	.00205	.00218	.00230	137,000	47
48	.00129	.00140	.00150	204,900	.00139	.00155	.00170	196,900	.00159	.00175	.00190	188,900	.00169	.00190	.00210	180,900	48
49	.00117	.00124	.00130	259,700	.00127	.00139	.00150	247,500	.00147	.00159	.00170	235,300	.00157	.00174	.00190	223,100	49
50	.00105	.00113	.00120	324,700	.00115	.00128	.00140	307,700	.00125	.00143	.00160	290,700	.00135	.00158	.00180	273,700	50
51	.00095	.00103	.00110	406,500	.00105	.00117	.00129	383,100	.00115	.00133	.00150	359,700	.00125	.00148	.00170	336,300	51
52	.00085	.00093	.00100	507,600	.00095	.00107	.00105	476,200	.00105	.00123	.00140	444,800	.00115	.00138	.00160	413,400	52
53	.00072	.00079	.00085	653,600	.00080	.00090	.00103	621,100	.00087	.00104	.00121	588,600	.00097	.00118	.00139	556,100	53
54	.00065	.00070	.00075	826,400	.00073	.00082	.00095	775,200	—	—	—	—	—	—	—	—	54
55	.00058	.00064	.00070	1,032,000	.00066	.00075	.00087	961,500	—	—	—	—	—	—	—	—	55

*Diameters shown are per NEMA MW1000-1997. For Diameters per NEMA MW1000-2015 see page 5 or visit our website at www.mwswire.com

Red text above indicates sizes not covered by NEMA MW1000-1997. Values derived from MWS Wire Industries internal standards.

Half-Size Copper Magnet Wire

Dimensional values derived from NEMA MW1000-1997 Standard

SIZE (AWG)	BARE COPPER									SINGLE BUILD DIAMETER (INCHES)			HEAVY BUILD DIAMETER (INCHES)		
	DIAMETER (INCHES)			RESISTANCE (OHMS PER 1000 FT. AT 20□C)			FEET PER POUND	POUNDS PER 1000 FT.	CIRCULAR MILS						
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.			NOMINAL	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
4½	.1912	.1931	.1950	.2727	.2781	.2837	8.86	112.9	37290	——	——	——	.1949	.1968	.1986
5½	.1703	.1720	.1737	.3437	.3506	.3576	11.17	89.55	29580	——	——	——	.1736	.1754	.1772
6½	.1517	.1532	.1547	.4334	.4419	.4507	14.08	71.04	23470	——	——	——	.1549	.1566	.1582
7½	.1350	.1364	.1378	.5462	.5574	.5682	17.76	56.31	18600	——	——	——	.1382	.1398	.1413
8½	.1203	.1215	.1227	.6889	.7025	.7178	22.38	44.68	14760	——	——	——	.1234	.1248	.1261
9½	.1071	.1082	.1093	.8697	.8859	.9025	28.22	35.44	11710	——	——	——	.1101	.1114	.1126
10½	.0952	.0962	.0972	1.10	1.12	1.14	35.6	28.1	9270	——	——	——	.0983	.0994	.1004
11½	.0847	.0856	.0865	1.38	1.41	1.44	44.9	22.3	7360	——	——	——	.0877	.0887	.0897
12½	.0755	.0763	.0771	1.74	1.78	1.81	56.6	17.7	5840	——	——	——	.0784	.0793	.0802
13½	.0672	.0679	.0686	2.20	2.24	2.29	71.4	14.0	4620	——	——	——	.0700	.0708	.0716
14½	.0599	.0605	.0611	2.77	2.82	2.88	90.0	11.1	3670	.0615	.0623	.0630	.0631	.0639	.0646
15½	.0534	.0539	.0544	3.49	3.56	3.64	113	8.83	2920	.0549	.0555	.0561	.0564	.0570	.0576
16½	.0475	.0480	.0485	4.41	4.48	4.58	143	7.00	2310	.0489	.0496	.0503	.0504	.0511	.0517
17½	.0423	.0427	.0431	5.56	5.66	5.77	180	5.55	1830	.0437	.0443	.0448	.0451	.0457	.0463
18½	.0376	.0380	.0384	7.00	7.14	7.30	228	4.39	1450	.0389	.0395	.0401	.0402	.0408	.0414
19½	.0336	.0339	.0342	8.81	8.97	9.19	286	3.50	1160	.0348	.0353	.0358	.0361	.0366	.0370
20½	.0299	.0302	.0305	11.1	11.4	11.6	362	2.76	912	.0311	.0316	.0321	.0322	.0328	.0333
21½	.0266	.0269	.0272	14.0	14.3	14.5	457	2.19	724	.0277	.0282	.0287	.0288	.0293	.0298
22½	.0237	.0239	.0241	17.7	18.0	18.5	573	1.74	576	.0248	.0252	.0255	.0258	.0262	.0266
23½	.0211	.0213	.0215	22.2	22.6	23.3	721	1.39	458	.0221	.0226	.0230	.0231	.0236	.0240
24½	.0188	.0190	.0192	28.1	28.7	29.3	915	1.09	361	.0198	.0202	.0206	.0207	.0212	.0216
25½	.0167	.0169	.0171	35.5	36.3	37.2	1160	.865	286	.0176	.0180	.0184	.0185	.0189	.0193
26½	.0148	.0150	.0152	44.3	45.5	46.7	1450	.690	228	.0158	.0162	.0165	.0166	.0170	.0174
27½	.0133	.0134	.0135	56.1	57.7	58.6	1840	.543	180	.0141	.0145	.0148	.0149	.0153	.0156
28½	.0118	.0119	.0120	70.8	73.2	74.5	2290	.436	144	.0126	.0130	.0133	.0134	.0137	.0140
29½	.0105	.0106	.0107	90.6	92.3	94.0	2940	.340	112	.0112	.0116	.0119	.0120	.0123	.0126
30½	.0094	.0095	.0096	112.5	114.9	117.4	3660	.2732	90.25	.0101	.0104	.0107	.0108	.0111	.0114
31½	.0083	.0084	.0085	143.5	147.0	150.5	4680	.2136	70.56	.0089	.0092	.0095	.0096	.0099	.0103
32½	.0074	.0075	.0076	179.6	184.4	189.4	5870	.1703	56.25	.0080	.0083	.0086	.0086	.0090	.0093
33½	.0066	.0067	.0068	224.3	231.0	238.1	7360	.1359	44.89	.0071	.0074	.0077	.0077	.0081	.0084
34½	.0058	.0059	.0060	288.1	297.9	308.3	9490	.1054	34.81	.0063	.0065	.0068	.0068	.0071	.0074
35½	.0052	.0053	.0054	355.7	369.2	383.5	11760	.08503	28.09	.0056	.0058	.0061	.0061	.0064	.0067
36½	.0046	.0047	.0048	450.1	469.5	490.1	14950	.06687	22.09	.0050	.0053	.0055	.0054	.0057	.0060
37½	.0041	.0042	.0043	560.9	587.9	617.0	18730	.05340	17.64	.0044	.0047	.0050	.0049	.0052	.0054
38½	.0036	.0037	.0038	718.2	757.7	800.2	24130	.04144	13.69	.0038	.0041	.0044	.0043	.0046	.0048
39½	.0032	.0033	.0034	897.1	952.3	1013	30340	.03296	10.89	.0034	.0037	.0039	.0038	.0041	.0043
40½	.0029	.0030	.0031	1079	1152	1233	36710	.02724	9.00	.0031	.0034	.0036	.0035	.0037	.0039
41½	.0025	.0026	.0027	1423	1534	1659	48880	.02046	6.76	.0027	.0029	.0031	.0030	.0032	.0034
42½	.0023	.0024	.0025	1659	1801	1960	57340	.01744	5.76	.0025	.0026	.0028	.0027	.0029	.0031
43½	.0020	.0021	.0022	2143	2352	2593	74900	.01335	4.41	.0021	.0023	.0025	.0024	.0026	.0028
44½	.0018	.0019	.0020	2593	2873	3201	91490	.01093	3.61	.0019	.0021	.0023	.0022	.0024	.0026
45½	.00160	.00166	.00173	3465	3764	4051	119,900	.00834	2.7556	.00170	.00182	.00194	.00190	.00205	.00220
46½	.00142	.00148	.00154	4373	4735	5143	150,800	.00663	2.1904	.00152	.00163	.00174	.00172	.00186	.00200
47½	.00127	.00132	.00137	5526	5952	6430	189,700	.00527	1.7424	.00137	.00148	.00159	.00157	.00169	.00181
48½	.00113	.00117	.00122	6968	7576	8122	241,500	.00414	1.3689	.00123	.00133	.00143	.00133	.00144	.00155
49½	.00101	.00105	.00109	8729	9407	10167	299,400	.00334	1.1025	.00111	.00119	.00127	.00121	.00132	.00143
50½	.00090	.00093	.00097	11022	11991	12804	382,000	.002618	.8649	.00100	.00108	.00115	.00110	.00121	.00132

Diameters shown are per NEMA MW1000-1997. For Diameters per NEMA MW1000-2015 see page 6 or visit our website at www.mwswire.com

Values below derived from NEMA MW1000-1997 Standard

SIZE (AWG)	BARE WIRE DIAMETER (INCHES)			TYPE 1				TYPE 2				SIZE (AWG)
				MIN. INCREASE IN DIAMETER (INCHES)		OVERALL DIAMETER (INCHES)		MIN. INCREASE IN DIAMETER (INCHES)		OVERALL DIAMETER (INCHES)		
	MIN.	NOM.	MAX.	FILM	BOND COAT	MIN.	MAX.	FILM	BOND COAT	MIN.	MAX.	
14	.0635	.0641	.0647	.0016	.0006	.0657	.0682	.0032	.0006	.0673	.0700	14
15	.0565	.0571	.0577	.0015	.0006	.0586	.0609	.0030	.0006	.0601	.0627	15
16	.0503	.0508	.0513	.0014	.0006	.0523	.0545	.0029	.0006	.0538	.0562	16
17	.0448	.0453	.0458	.0014	.0006	.0468	.0488	.0028	.0006	.0482	.0504	17
18	.0399	.0403	.0407	.0013	.0006	.0418	.0437	.0026	.0006	.0431	.0452	18
19	.0355	.0359	.0363	.0012	.0006	.0373	.0391	.0025	.0006	.0386	.0406	19
20	.0317	.0320	.0323	.0012	.0005	.0334	.0351	.0023	.0005	.0345	.0364	20
21	.0282	.0285	.0288	.0011	.0005	.0298	.0314	.0022	.0005	.0309	.0326	21
22	.0250	.0253	.0256	.0011	.0005	.0266	.0281	.0021	.0005	.0276	.0293	22
23	.0224	.0226	.0228	.0010	.0005	.0239	.0253	.0020	.0005	.0249	.0264	23
24	.0199	.0201	.0203	.0010	.0005	.0214	.0227	.0019	.0005	.0223	.0238	24
25	.0177	.0179	.0181	.0009	.0005	.0191	.0203	.0018	.0005	.0200	.0214	25
26	.0157	.0159	.0161	.0009	.0005	.0171	.0182	.0017	.0005	.0179	.0193	26
27	.0141	.0142	.0143	.0008	.0005	.0154	.0164	.0016	.0005	.0162	.0173	27
28	.0125	.0126	.0127	.0008	.0005	.0138	.0147	.0016	.0005	.0146	.0156	28
29	.0112	.0113	.0114	.0007	.0004	.0123	.0133	.0015	.0004	.0131	.0142	29
30	.0099	.0100	.0101	.0007	.0004	.0110	.0119	.0014	.0004	.0117	.0128	30
31	.0088	.0089	.0090	.0006	.0004	.0098	.0108	.0013	.0004	.0105	.0115	31
32	.0079	.0080	.0081	.0006	.0004	.0089	.0098	.0012	.0004	.0095	.0102	32
33	.0070	.0071	.0072	.0005	.0004	.0079	.0088	.0011	.0004	.0085	.0095	33
34	.0062	.0063	.0064	.0005	.0003	.0070	.0078	.0010	.0003	.0075	.0084	34
35	.0055	.0056	.0057	.0004	.0003	.0062	.0070	.0009	.0003	.0067	.0076	35
36	.0049	.0050	.0051	.0004	.0003	.0056	.0063	.0008	.0003	.0060	.0069	36
37	.0044	.0045	.0046	.0003	.0003	.0050	.0057	.0008	.0003	.0055	.0062	37
38	.0039	.0040	.0041	.0003	.0002	.0044	.0051	.0007	.0002	.0048	.0056	38
39	.0034	.0035	.0036	.0002	.0002	.0038	.0045	.0006	.0002	.0042	.0050	39
40	.0030	.0031	.0032	.0002	.0002	.0034	.0040	.0006	.0002	.0038	.0044	40
41	.0027	.0028	.0029	.0002	.0002	.0031	.0036	.0005	.0002	.0034	.0040	41
42	.0024	.0025	.0026	.0002	.0002	.0028	.0032	.0004	.0002	.0030	.0037	42
43	.0021	.0022	.0023	.0002	.0001	.0024	.0029	.0004	.0001	.0026	.0033	43
44	.0019	.0020	.0021	.0001	.0001	.0021	.0027	.0004	.0001	.0024	.0030	44
45	.00169	.00176	.00183	.0001	.0001	.00189	.0023	.0003	.0001	.00209	.0025	45
46	.00151	.00157	.00164	.0001	.0001	.00171	.0021	.0003	.0001	.00191	.0023	46
47	.00135	.00140	.00146	.0001	.0001	.00155	.0019	.0003	.0001	.00175	.0021	47
48	.00119	.00124	.00129	.0001	.0001	.00137	.0017	.0002	.0001	.00149	.0018	48
49	.00107	.00111	.00116	.0001	.0001	.00127	.0015	.0002	.0001	.00137	.0017	49
50	.00095	.00099	.00103	.0001	.0001	.00115	.0014	.0002	.0001	.00125	.0016	50

Diameters shown are per NEMA MW1000-1997. For Diameters per NEMA MW1000-2015 see page 9 or visit our website at www.mwswire.com

Bondable Wire Grades - Types Defined

TYPE	INSULATION AND BONDCOAT CONFIGURATION
1	Equal to Single Build* plus bondcoat
2	Equal to Heavy Build* plus bondcoat

The addition of a bondcoat will result in an increase in the finished diameter of the wire.

* For standard round magnet wire insulation build diameters (e.g. Single, Heavy, Triple & Quad) see page 5.

Recommended Winding Tensions

Below are recommended winding tension for round magnet wire with Copper and Aluminum conductors. They are strictly recommendations and it is suggested that you use your own validation tests to ensure that the wire is not stretched during your production process.

SIZE (AWG)	RECOMMENDED WINDING TENSIONS FOR ROUND COPPER AND ALUMINUM CONDUCTORS								SIZE (AWG)
	COPPER				ALUMINUM				
	Minimum		Maximum		Minimum		Maximum		
	lbs / oz	kg / g	lbs / oz	kg / g	lbs / oz	kg / g	lbs / oz	kg / g	
10	61 lbs	28 kg	82 lbs	37 kg	12 lbs	6 kg	22 lbs	10 kg	10
11	48	22	65	29	10	4	18	8	11
12	38	17	51	23	8	3	14	6	12
13	31	14	41	18	6	3	11	5	13
14	24	11	32	15	5	2	9	4	14
15	19	8.7	26	12	4	2	7	3	15
16	15	6.9	20	9.2	3	1	6	3	16
17	12	5.5	16	7.3	2	1	4	2	17
18	10	4.3	13	5.8	2	1	4	2	18
19	8	3.4	10	4.6	2	1	3	1	19
20	6	2.7	8	3.6	1.25	.55	2	2	20
21	5	2.2	6	2.9	1	.43	1.8	0.8	21
22	4	1.7	5	2.3	0.8	.34	1.4	0.6	22
23	3	1.4	4	1.8	0.6	.27	1.1	0.5	23
24	2	1.1	3	1.4	0.5	.22	.9	0.4	24
25	2	0.9	3	1.1	0.4	.17	.7	0.3	25
26	1	0.7	2	0.9	0.3	.14	.5	0.2	26
27	1	0.5	2	0.7	0.2	.11	.4	0.2	27
28	15 **oz**	425 **g**	20 **oz**	565 **g**	3 **oz**	85 **g**	6 **oz**	160 **g**	28
29	12	340	16	455	2.5	68	4.5	125	29
30	9	270	13	360	2	54	3.5	99	30
31	7	210	10	280	1.5	42	2.8	78	31
32	6	170	8	290	1.20	34	2.20	63	32
33	5	135	6	180	.95	27	1.75	49	33
34	4	105	5	140	.75	21	1.40	39	34
35	3	85	4	110	.60	17	1.10	31	35
36	2	65	3	90	.45	13	.85	24	36
37	2	55	3	70	.38	11	.71	20	37
38	2	45	2	55	.29	8.6	.56	16	38
39	1.2	35	1.5	45	.23	6.5	.42	12	39
40	0.9	25	1.2	35	.18	5.1	.33	9.4	40
41	0.7	20	1.0	28	.15	4.2	.27	7.7	41
42	0.6	17	0.8	22	.12	3.3	.22	6.1	42
43	0.5	13	0.6	17	.09	2.6	.17	4.7	43
44	0.4	10	0.5	13	.07	2.1	.14	3.9	44

Maximum vaulue above based on yeild strength of fully annealed copper wire.
Winding tensions higher than the stated maximums may cause higher resistance values.

Products in Inventory

As a commitment to clean energy, in 2007 MWS Wire Industries installed a grid tied 155 kW PV solar generating system at our facility in Westlake Village, California.

Aluminum
1350, 1100, 1199, 5056, 6061
Beryllium Copper CDA172000
Brass Alloy CDA26000
Bus Wire Tinned and Bare
Constantan
Copper Wires CDA10100, CDA10200, CDA11000
Copper Clad Aluminum
Copper Clad Steel
Dumet Bare, Plated
Gold 99.99% Pure
Inconel®
Kovar
Litz Wire Served and Unserved
Lockwire MS20995

Magnet Wire
Round sizes to 56 AWG, Square and Rectangular, NEMA MW 1000, IEC 60317, Colors, Half-sizes, Bondable, Copper, Aluminum and Special Conductors
Monel®
Microsquare™ Magnet Wire
Miniature Square and Rectangular Smaller than 14 AWG
Multifilar® Magnet Wire
2 - 20 Conductors, 16 - 52 AWG, Parallel Bonded, Color Coded
Nickel 200, 201, 205, 270
Phosphor Bronze CDA51000

Plated Wire and Ribbon
Gold, Silver, Nickel, Tin, Tin/Lead Solder, Cadmium
Platinum Alloys
Resistance Alloys
Nickel-Chrome, Copper-Nickel, Nickel-Iron, Manganin
Silver 99.9% & 99.99% Pure
Stainless Steel 302, 304, 316, 321
Teflon Magnet Wire
Tungsten
Twistite™ Magnet Wire
16 to 52 AWG
In some constructions, up to 50 twists per inch(TPI)
Up to 10 Colors in Some Sizes

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