Polytetrafluoroethylene Insulated Single Stranded Copper Wire; 1000 Volts-200°C

GE Material B23K1 identifies single-conductor stranded copper wire with polytetrafluoroethylene insulation for 1000 volt service, as follows:

GE designation	Description
B23K1A	0.015 inch wall, standard stranding
B23K1B	0.015 inch wall, semi-flexible stranding
B23K1C	0.015 inch wall, flexible stranding
B23K1D	0.012 inch wall, standard stranding
B23K1E	0.012 inch wall, semi-flexible stranding
B23K1F	0.015 inch wall, standard stranding, treated surface
B23K1G	0.015 inch wall, semi-flexible stranding, treated surface
B23K1H	0.015 inch wall, flexible stranding, treated surface
B23K1J	0.012 inch wall, standard stranding, treated surface
B23K1K	0.012 inch wall, semi-flexible stranding, treated surface

See table of Dimensions and Tolerances for complete GE designation.

MATERIAL REQUIREMENTS:

Conductor – The individual wires before stranding shall be silver-coated soft or annealed round copper wire conforming to GE Material B11B10A before coating and stranding.

Insulation – Shall be polytetrafluoroethylene applied as a tape, by dip coating or by extrusion and may be solid or laminated in structure. A laminated structure shall be fused under heat and pressure into a homogeneous wall.

ELECTRICAL PROPERTIES:

Spark test, volts, min (1)	5000
Dielectric strength, after 4 hrs in water at 23 ± 5°C, volts, min	3000
Insulation resistance, after 4 hrs in water at 23 ± 5°C, megohms/1000 ft, min (1)	5000
Dielectric constant, as received, max	2.2
Power factor, as received, % max	0.5
Surface resistance:	
After 96 hrs at 23°C and 95% RH, megohms-inches, min	5
Change from initial value after subjection to 2500 volt, 60 cycle potential for one minute, %, ±	50

(1) Values changed to meet NEMA HP-3, Type EE latest revision.

THERMAL PROPERTIES:

Heat resistance – After aging a sample consisting of 12 inches plus length required for winding on mandrel, for 96 hours at 290°C, followed by removal from the aging chamber and allowing to come to room temperature, the wire shall not be exposed at the ends more than 1/8 inch. After winding the heat aged wire five complete turns on a 3X mandrel and immersing the coil in water for one hour, the insulation shall withstand 3000 volts for one minute.

Cold bend test – After conditioning for four hours at -65°C, bending the wire at that temperature around a mandrel of the size specified in the following table, and immersing the coiled wire in water for one hour, the insulation shall withstand 3000 volts.

AWG size	Mandrel diameter, inch
30-16	1
14-12	2
10	3

Solder test – When a specimen of wire which has had 1/2 inch of insulation removed from the end and has been bent at right angles 1/2 inch from the end of the insulation is immersed for five seconds to within 1/8 inch of the insulation in molten 60 tin/40 lead solder at approximately 320°C, the insulation shall not flare away from the conductor, open up over the bend portion, nor shrink back more than 1/8 inch.

Flammability – When a bunsen burner flame is applied for 30 seconds to the wire held at 45 degrees to the vertical, the insulation shall not burn for more than 30 seconds nor shall the flame travel more than three inches.

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ADDITIONAL REQUIREMENTS:

Construction:

Stranding – The conductor shall be stranded as specified in the table of Dimensions and Tolerances.

Splices – The stranded conductor as a whole shall not be spliced.

Coated conductor – The conductor, before stranding, shall be plated with a smooth continuous layer of commercially pure silver firmly adherent to the surface of the copper. The coating shall not be less than 40 microinches (0.00004 inch) in thickness. The continuity of the silver coating shall be determined by the ASTM B298 (standard sodium polysulfide test) and shall be considered as failing if it shows blackening, parting or cracking of the coating.

Insulation – The polytetrafluoroethylene insulation shall be homogeneous in character, tough, elastic and applied concentrically about the conductor. The thickness shall be as specified in the table of Dimensions and Tolerances.

Surface – The surface of B23K1A, B, C, D, and E shall be smooth and free from tackiness. The surface of B23K1F, G, H, J and K shall be treated as agreed upon between supplier and purchaser to improve its bondability.

Repairs of joints – Where repairs of joints are made in the insulation, the work shall be done in such manner that the repaired part of the joint, and all parts affected in the process, shall be as strong and durable electrically and mechanically as the remainder of the insulation and shall not exceed the limitations on thickness.

Stripping – The insulation shall strip freely and easily from the conductor.

Color (B23K1A, B, C, D and E only) – Shall be as specified on the purchase order and may be any of the following:

Color	Lightest shade				Darkest shade			
	International Commission on Illumination			Munsell book notation	International Commission on Illumination			Munsell book notation
	Coordinates		Apparent reflectance, %		Coordinates		Apparent reflectance, %	
	X	Y			X	Y		
White	-	-	-	-	0.3681	0.3776	59.3	3.5Y 8.2/4.6
Red	0.5298	0.3126	11.2	5.OR 3.7/11.5	0.4569	0.2991	6.2	4.5R 2.5/7.5
Green	0.3394	0.4467	39.5	8.OGY 6.6/6.4	0.2643	0.4766	11.2	2.5G 3.5/7.3
Yellow	0.4152	0.4185	62.9	2.5Y 8.3/8.1	0.4766	0.4443	50.5	10.OYR 7.4/10.8
Brown	0.3775	0.3424	7.4	3.5YR 3.0/2.0	0.3640	0.3365	6.1	4.OYR 2.7/1.6
Blue	0.2381	0.2749	20.1	6.OB 5.0/4.0	0.2279	0.2516	10.9	9.5B 3.6/4.5
Orange	0.5424	0.3837	25.7	1.OYR 5.6/13.1	0.5752	0.3634	19.2	9.5R 5.0/14.0
Gray	0.3170	0.3301	31.8	3.OGY 6.1/0.6	0.3048	0.3105	18.0	4.OPB 4.8/0.2
Purple	0.3070	0.2466	11.9	6.5P 3.9/5.0	0.2647	0.2247	5.4	10.OPB 2.5/3.2
Tan	0.3861	0.3591	21.0	7.OYR 5.2/3.5	0.3881	0.3552	10.1	6.OYR 3.5/2.3
Pink	0.3896	0.3156	41.9	4.5R 6.9/8.8	0.4109	0.2959	13.9	10.ORP 4.2/6.5
Black	-	-	-	-	-	-	-	-

WINDING AND IDENTIFICATION:

Winding – All wire shall be wound on spools under sufficient tension to provide an even and compact winding. A soft body of wire shall be considered unsatisfactory.

Identification – Each spool shall be legibly marked with the manufacturer's name, size, net weight and length of wire and the GE designation.

REFEREE METHODS:

Spark test	GE E8D9
Dielectric strength	ASTM D470
Dielectric constant and power factor	ASTM D150 (2)
Insulation resistance	ASTM D470
Continuity of silver coating	ASTM B298
Thickness of silver coating	ASTM B298

(2) Use a sufficient length of wire so that the measured capacitance is not less than 100 micromicrofarads. Ground the external surface by application of sprayed metal or by immersion in mercury. Determine the power factor and capacitance by either the bridge method or the resonant circuit substitution method at room temperature and a frequency of 1 megacycle per second. Measure power factor directly and calculate dielectric constant, as follows:

$$K = 136\ C \log_{10} (D/d)$$

Where C = capacitance of specimen in microfarads/1000 ft
D = average outer diameter over insulation
d = average diameter of conductor

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REFEREE METHODS: (Continued)

Surface resistance – Specimens shall consist of six-inch lengths of wire provided with two 1/4 inch ring-type metal-foil electrodes or, for small wires, several turns of fine tin-coated copper wire, spaced 1.0 inch apart between nearest edges near the center of the specimen length. Condition specimens 96 hours at 23 ± 5°C and 95% RH and measure the surface resistance between the electrodes with a dc potention of 200-300 volts while specimen is still in the conditioning chamber, after one-minute electrification.

Following the initial measurement, apply a 2500 volt, 60 cycle potential between the electrodes for one minute. Measure the surface resistance again after a 15-20 minute discharge interval.

RETESTS:

In case of failure under any tests herein specified, the test or tests under which the wire failed shall be repeated twice and the wire shall be regarded as meeting the requirements of this specification if the two additional tests are satisfactory. The wire shall be regarded as not meeting the requirements of this specification if the results of either of the two additional tests are unsatisfactory.

DIMENSIONS AND TOLERANCES:

GE designation	Conductor				Insulation		Completed wire	
	Size, AWG	Suggested No. and size of wires, inch	Nominal diameter, inch	Length of lay, inch max	Wall thickness, inch		Diameter, inch	
					Nom	Min	Min	Max
B23K1A1, F1	30	7/0.0040	0.0120	0.187	0.015	0.013	0.038	0.046
B23K1A2, F2	28	7/0.0050	0.0150	0.20	0.015	0.013	0.041	0.049
B23K1A3, F3	26	7/0.0063	0.0189	0.25	0.015	0.013	0.045	0.053
B23K1A4, F4	24	7/0.0080	0.0240	0.33	0.015	0.013	0.050	0.058
B23K1A5, F5	22	7/0.0100	0.0300	0.33	0.015	0.013	0.056	0.064
B23K1A6, F6	20	7/0.0126	0.0378	0.50	0.015	0.013	0.064	0.072
B23K1A7, F7	18	7/0.0159	0.0477	0.62	0.015	0.013	0.074	0.084
B23K1B1, G1	16	19/0.0113	0.0531	0.75	0.015	0.013	0.083	0.095
B23K1B2, G2	14	19/0.0142	0.0667	0.875	0.015	0.013	0.098	0.114
B23K1B3, G3	12	19/0.0179	0.0841	1.00	0.015	0.013	0.117	0.133
B23K1B4, G4	22	19/0.0063	0.0296	0.33	0.015	0.013	0.057	0.065
B23K1B5	24	19/0.0050	0.0235	0.33	0.015	0.013	0.050	0.058
B23K1B6	18	19/0.0100	0.0470	0.62	0.015	0.013	0.074	0.084
B23K1C1, H1	10	37/0.0159	0.0108	1.50	0.015	0.013	0.137	0.153
B23K1D1, J1	24	16/0.005	0.024	0.33	0.012	0.010	-	0.057
B23K1E1, K1	22	27/0.005	0.030	0.33	0.012	0.010	-	0.063

CERTIFICATE OF TEST:

When requested, the supplier shall submit promptly to the purchaser at the point of delivery a certificate of test showing the results of those tests for any one or more of the requirements of this specification as specified by the purchaser. This certificate shall be addressed to the section, unit, or person specified on the purchase order, and shall contain the GE or NEMA designation as applicable, the purchase order number, and the quantity shipped so that the certificate may be identified with the shipment.

PACKING AND MARKING:

Spools, reels or containers shall be prepared for shipment in such a manner as to adequately protect the wire during shipment and handling.

Each box, crate, bundle, etc. shall be legibly marked with the purchase order number, supplier's name, size of wire, net weight of wire and the GE or NEMA designation, as applicable.