

AMETEK AEROSPACE PRODUCTS INC. WILMINGTON, MA 01887 CAGE CODE: 97424 Formerly GE Instrument Products Oper	<u>MATERIALS-PROCESSES-FINISHES</u> <u>INTERNAL SPECIFICATION</u> <u>COVER SHEET</u>
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(APPROVED SOURCE)

SPECIFICATION NUMBER: B50WL166-S14

DATE FIRST ISSUED: _____

Rev. S9 : Dec. 1, 1972

S10: July 18, 1986

S11: Oct. 17, 1988

S12: Jan. 24, 1990

S13: Nov. 8, 1990

S14: Oct. 12, 2004

TITLE: HIGH TEMPERATURE LEAD WIRE

ORIGINAL SIGNED BY:

PREPARED BY:
DESIGN ENGINEERING Std's 12/1/1972 _____
NAME DATE UNIT

DESIGN ASSURANCE
& STANDARDS _____
NAME DATE



APPROVED BY:
DESIGN ENGINEERING _____
NAME DATE UNIT

DESIGN ASSURANCE
& STANDARDS _____
NAME DATE

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MATERIALS-PROCESSES-FINISHES
INTERNAL SPECIFICATION
B50WL166

REVISIONS

LTR	DESCRIPTION	DATE ISSUED	APPROVED
S9		12-01-72	
S10		07-18-86	
S11		10-17-88	
S12		01-24-90	
S13	RDA 6009 - Add current design activity. Renumber all sheets.	11-08-90	
S14	ECO 17878 - add or tape wrapped and sintered.	10-18-04	

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MATERIALS-PROCESSES-FINISHES

INTERNAL SPECIFICATION

B50WL166-S14

CONTRACT NUMBERS

F33657-81-C-0210

N00019-86-C-0230

TAA 42.099

F34601-88-G-6604-SA15

F34601-91-G7703-SA33

:F42600-89-C-0832

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Formerly G.E. Instrument Products Operation

B50WL166-S14

Sheet 4

November 8, 19

SPECIFICATION & PROPERTIES

HIGH TEMPERATURE LEAD WIRE

AAPI Material B50WL166 identifies single conductor stranded and solid lead wire with polytetrafluoroethylene (PTFE**) insulation, as follows:

<u>AAPI Designation</u>	<u>Description</u>	<u>Previous Designation</u>
B50WL166A	Copper conductor, standard wall	B50WL166A
B50WL166A2	Copper conductor, standard wall, shielded	B50WL166A2
B50WL166A3	Copper conductor, thin wall	B50WL166A3
B50WL166A4	Copper conductor, standard wall, shielded & jacketed (nylon braid)	
B50WL166A5	Copper conductor, standard wall, shielded & jacketed (extruded or tape wrapped and sintered PTFE)	
B50WL166B	Copperweld conductor, standard wall	B50WL166B

MATERIAL REQUIREMENTS:

Conductor - The bare wire for AAPI Material B50WL166A thru A5 shall be silver-coated soft or annealed round copper wire conforming to the latest specification requirements for GE Material B11B10A.

The bare wire for AAPI Material B50WL166B shall be silver-coated, high strength, 40% conductivity, round copper-clad steel wire conforming to the latest specification requirements for GE Material B4A2B.

Insulation - Shall be polytetrafluoroethylene (PTFE) applied as a tape or by extrusion and may be solid or laminated in structure. However, a laminated structure shall be fused under heat and pressure into a homogeneous wall during processing. Insulation shall be free of cuts, nicks, pinholes, and similar defects.

Shielding (B50WL166A2 & A4 only) - Shall be a closely woven braid of 36 AWG silver coated copper to provide not less than 90% coverage. Braided shield shall not increase the specified maximum diameter by more than 0.030 inch.

Jacket (B50WL166A4 only) - Shall be nylon lacquer impregnated nylon braid which shall not increase the diameter over the shielding by more than 0.016 inch.

Shielding and jacket (B50WL166A5 only) - Shielding shall be a closely woven braid of 36 AWG silver coated copper. Jacket shall be extruded or tape wrapped and sintered polytetrafluoroethylene. Shielding and jacket shall not increase the specified maximum diameter by more than 0.037 inch. Color of outer jacket must be same as color of insulation over bare wire.

**Trademarks used for PTFE by U.S. manufacturers are: Teflon, by DuPont Co.; Fluon, by ICI Americas; and Halon, by Allied Corp.

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CAGE CODE: 97424
Formerly G.E. Instrument Products Operation

B50WL166-S14
Sheet 5

November 8, 1964

SPECIFICATION & PROPERTIES
HIGH TEMPERATURE LEAD WIRE

<u>ELECTRICAL PROPERTIES:</u>	<u>B50WL166A, A2, A4, A5 & B</u>	<u>B50WL166A3</u>
Spark test, volts, min.....	3400	2500
Dielectric strength, after 4 hrs. in water at 25° ± 5°C, volts, min.....	2000	1500
Insulation resistance, after 4 hrs. in water at 25° ± 5°C, megohms/1000 ft, min.	5000	5000
Dielectric constant, as received, max.....	2.2	2.2
Power factor, as received, %, max.....	0.5	0.5
Surface resistance:		
After 96 hrs. at 25°C and 95% RH, megohms, min.....	5	5
Change from initial value after subjection to 2500 volts, 60 cycle potential for one minute, %, ±	50	50

THERMAL PROPERTIES:

Heat resistance - After heating for 96 hours at 250 C, the wire shall not be exposed at the ends more than 1/8 inch and 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 2200 volts for one minute for AAPI Materials B50WL166A, A2, A4, A5, and B 1500 volts for AAPI Material B50WL166A3.

Cold bend test - After conditioning for four hours at 65 C, bending the wire at that temperature around a one-inch diameter⁽¹⁾ mandrel, and immersing the coiled wire in water for one hour, the insulation shall withstand 2200 volts for AAPI Material B50WL166A, A2, A4, A5 and B, and 1500 volts for AAPI Material B50WL166A3.

(1) Two-inch diameter for AWG #14 wire

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 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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CAGE CODE: 97424

Formerly G.E. Instrument Products Operation

B50WL166-S14

Sheet 6

November 8, 1

SPECIFICATION & PROPERTIES

HIGH TEMPERATURE LEAD WIRE

MANUFACTURE:

Construction:

Stranding - Conductor shall be stranded as specified in the table of Dimensions and Tolerances. Compliance with latest issue of MIL-W-16878, Table I, "Details of Conductors", shall be acceptable.

Splices - Conductor as a whole shall not be spliced.

Insulation - The polytetrafluoroethylene insulation shall be homogeneous in character, tough, elastic and applied concentrically about the conductor. The insulation shall not be so loose as to slide readily from the conductor in the handling of short cut lengths of wire.

Repairs or joints - Where repairs or joints are made in the insulation, the work shall be done in such a 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 - Insulation shall strip freely and easily from the conductor.

Surface - The surface shall be smooth and free from tackiness.

Color - Shall be as specified on the purchase order. Color shall not change after subjection to a temperature of 250 C for six hours. For shielded and jacketed wire the color of the outer jacket must be the same as the insulation over the bare conductor.

WINDING AND IDENTIFICATION:

Winding - All wire shall be wound on spools under sufficient tension to provide an even and compact winding.

Identification - Each spool shall be legibly marked with the manufacturer's name, size of lead wire, number of feet, and the AAPI designation.

REFEREE METHODS:

Spark test..... GE ESD9
Dielectric strength..... ASTM D470
Insulation resistance..... ASTM D470
Dielectric constant and power factor..... ASTM D150⁽²⁾

(2) Use a sufficient length of wire so that the measured capacitance is not less than 100 microfarads. Ground the external surface by application of sprayed metal or by immersion in mercury. Determine 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:

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

where: C = capacitance in microfarads/1000 ft
D = average OD over insulation
d = average diameter of conductor

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AEROSPACE PRODUCTS INC., WILMINGTON, MA 01887-2190

CAGE CODE: 97424

Formerly G.E. Instrument Products Operation

B5OWL166-S14
Sheet 7

November 8, 1

SPECIFICATION & PROPERTIES

HIGH TEMPERATURE LEAD WIRE

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 25 \pm 2°C and 95% RH and measure the surface resistance between the electrodes with a d-c potential 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.

DIMENSIONS AND TOLERANCES: B5OWL166A, A2, A4, A5 and B:

CONDUCTOR					INSULATION			
Size AWG	No. of Strands	Size of strands		Nominal diameter inch	Wall thickness, inch		OD over insulation, inch	
		AWG	Dia		Nom	Min	Min	Max
30	7	38	.004	.012	.010	.008	.028	.036
28	7	36	.005	.015	.010	.008	.031	.039
28	19	40	.003	.016	.010	.008	.031	.039
26	7	34	.006	.019	.010	.008	.035	.043
24	1	24	.0201	.020	.010	.008	.036	.044
24	7	32	.008	.024	.010	.008	.040	.048
24	19	36	.005	.025	.010	.008	.040	.048
22	1	22	.0254	.025	.010	.008	.041	.049
22	7	30	.010	.030	.010	.008	.046	.054
22	19	34	.006	.031	.010	.008	.046	.054
22	**27	36	.005	.030	.010	.008	.046	.054
22	**63	40	.003	.029	.010	.008	.045	.053
20	7	28	.013	.038	.010	.008	.054	.062
20	19	32	.008	.040	.010	.008	.054	.062
18	7	26	.016	.048	.010	.008	.064	.074
18	19	30	.010	.050	.010	.008	.064	.074
16	19	29	.011	.057	.012	.008	.073	.087
14	19	27	.014	.072	.012	.008	.088	.102
32	1	32	.008	.008	.010	.008	.025	.033
32	7	40	.003	.010	.010	.008	.026	.034
30	1	30	.010	.010	.010	.008	.026	.034
28	1	28	.0126	.013	.010	.008	.028	.036
26	1	26	.016	.016	.010	.008	.032	.040
26	19	38	.004	.020	.010	.008	.035	.043
20	1	20	.032	.032	.010	.008	.042	.046
18	1	18	.0403	.040	.010	.008	.056	.066
16	1	16	.0508	.051	.012	.008	.067	.081
16	19	29	.0113	.055	.012	.008	.073	.087
14	1	14	.0641	.064	.012	.008	.079	.089

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Formerly G.E. Instrument Products Operation

B50WL166-S14

Sheet 8

November 8, 1

SPECIFICATION & PROPERTIES

HIGH TEMPERATURE LEAD WIRE

NOTES:

- (1) Where applicable, compliance with the following is acceptable:
 - MIL-W-16878: Table I - Details of Conductors
 - MIL-W-16878/4: Table I - Construction Details (Extruded PTFE)
 - MIL-W-16878/21: Table I - Construction Details (Wrapped PTFE)
- (2) For A2, A4, and A5: without shielding and/or jacket
- (3) Preferred stranding is seven (7) for wire smaller than 26 awg, 19 for 26 aw and larger.
- (4) Nominal values are for information only. For min/max dia of conductors, se MIL-W-16878: Table I.

B50WL166A3 only: (1)(2)

CONDUCTOR					INSULATION			
Size AWG	No. of Strands	Size of strands		Nominal diameter inch	Wall thickness, inch		OD over insulation, inch	
		AWG	Dia		Nom	Min	Min	Max
30	7	38	.004	.012	.006	.004	.022	.026
30	1	30	.010	.010	.006	.004	.020	.024
28	7	36	.005	.015	.006	.004	.023	.027
28	1	28	.0126	.0131	.006	.004	.023	.027
26	7	34	.006	.024	.006	.004	.029	.033
26	19	38	.004	.025	.006	.004	.029	.033
26	1	26	.016	.016	.006	.004	.026	.030
24	19	36	.005	.024	.006	.004	.034	.038
28	19	40	.003	.016	.006	.004	.023	.027
24	7	32	.008	.024	.006	.004	.034	.038
24	1	24	.020	.020	.006	.004	.030	.034
22	19	34	.006	.032	.006	.004	.040	.044
22	7	30	.010	.030	.006	.004	.040	.044
22	1	22	.0254	.0254	.006	.004	.035	.040
20	19	32	.008	.040	.006	.004	.048	.032
20	7	28	.0126	.038	.006	.004	.048	.052
20	1	20	.032	.032	.006	.004	.042	.046

NOTES:

- (1) Where applicable, compliance with the following is acceptable:
 - MIL-W-16878: Table I - Details of Conductors
 - MIL-W-16878/6: Table I - Construction Details (Extruded PTFE)
 - MIL-W-16878/20: Table I - Construction Details (Wrapped PTFE)
- (2) Nominal values are for information only. For min/max dia of conductors, se MIL-W-16878: Table I.
- (3) Preferred stranding is seven (7) for wire smaller than 26 awg, 19 for 26 aw and larger.

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Formerly G.E. Instrument Products Operation

B5OWL166-S14

Sheet 9

November 8, 1

SPECIFICATION & PROPERTIES

HIGH TEMPERATURE LEAD WIRE

CERTIFICATE OF TEST:

When requested, the supplier shall submit promptly to the purchaser at the point of delivery a certificate of test in triplicate showing that the material conforms to this specification. This certificate shall be addressed to the section, unit or person specified on the purchase order and shall contain the AAPI designation and the purchase order number so that the certificate may be identified with the shipment.

PACKING AND MARKING:

Spools shall be packed in commercial containers to protect them from loss or damage during shipment and storage. Each container shall be legibly marked with the purchase order number, the manufacturer's name, size of wire, net weight of wire and the AAPI designation.

NOTES:

1. For applications requiring MIL-W-16878 Wire with extruded PTFE (Teflon) insulation use AAPI Spec. B5OWB71.

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Formerly G.E. Instrument Products Operation

B50WL166-S14
Sheet 10

November 8, 1

DATA FOR ORDERING**HIGH TEMPERATURE LEAD WIRE**

AAPI Material B50WL166 identifies single conductor stranded and solid lead wire with polytetrafluoroethylene (PTFE**) insulation, as follows:

<u>AAPI Designation</u>	<u>Description</u>	<u>Previous Designation</u>
B50WL166A	Copper conductor, standard wall	B50WL166A
B50WL166A2	Copper conductor, standard wall, shielded	B50WL166A2
B50WL166A3	Copper conductor, thin wall	B50WL166A3
B50WL166A4	Copper conductor, standard wall, shielded and jacketed (nylon braid)	
B50WL166A5	Copper conductor, standard wall, shielded and jacketed (extruded or tape wrapped and	teflon)---
B50WL166B	Copperweld conductor, standard wall	B50WL166B

Orders for this material should specify:

- Material name - High temperature lead wire
- Designation - AAPI Material B50WL166 (add proper suffix)
- Specification - B50WL166-S11
- Quantity, size, stranding and color of wire

The approved sources of supply for AAPI Material B50WL166 are:

Alpha Wire Corp., 711 Lidgerwood Ave.,
P.O. Box 711, Elizabeth, N.J. 07207-0711

Belden Electronic Wire & Cable
P.O. Box 1980, Richmond, IN 47375

Carlisle Corp., Tensolite Div.,
Old Post Rd., - Rte 9A., Buchanan, NY 10511

FL Industries, Inc., Suprenant Div.,
172 Sterling St., Clinton, MA 01510

Philadelphia Insulated Wire Co, Inc.
3333 New Albany Rd
Moorestown, NJ 08057

Harbour Industries, P.O. Box 188
Shelburne, VT 05482

W.L. Gore & Associates, Inc.
555 Paper Mill Road, P.O. Box 9329
Newark, DE 19711

Wirecraft Products
Rte. 9, West Brookfield, MA 01585

Authorized Distributors &
Representatives of Manufacturers
Listed Above.

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