REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

Prepared in accordance with ASME Y14.100 Selected item drawing

REV																		
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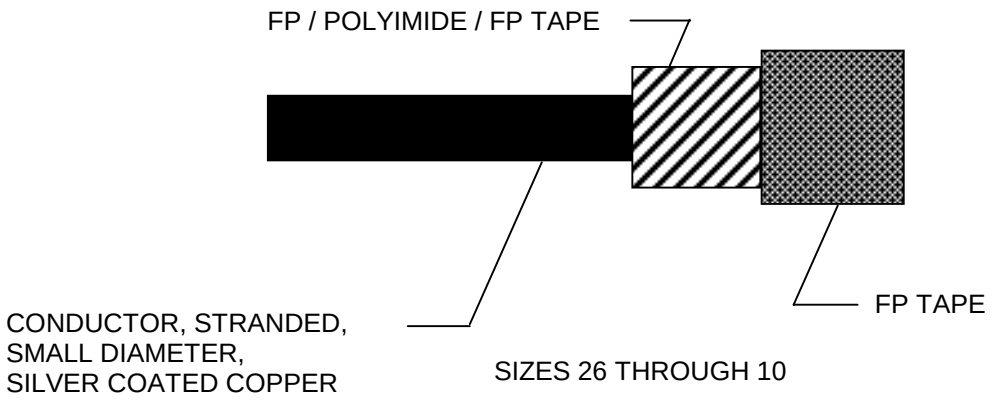
OF PAGES	PAGE	1	2	3	4	5	6	7	8	9	10	11						

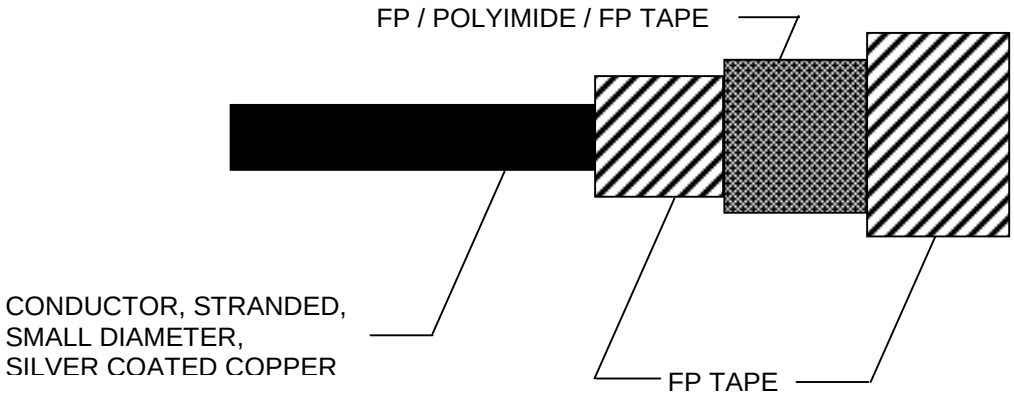
PMIC	PREPARED BY William Carpenter	DEFENSE SUPPLY CENTER, COLUMBUS COLUMBUS, OHIO 43216-5000
Original date of drawing 12 July 2004	CHECKED BY Lee Surowiec APPROVED BY Richard L. Taylor	TITLE WIRE, ELECTRICAL, COMPOSITE, POLYTETRAFLUOROETHYLENE/POLYIMIDE INSULATED, NORMAL WEIGHT, SILVER COATED, COPPER CONDUCTOR, 200°C, 600 VOLT
	SIZE: A / CAGE CODE: 037Z3 / REV	DWG. NO. 04040 PAGE 1 OF 11

AMSC N/A 6145-E062

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.



SIZES 26 THROUGH 10



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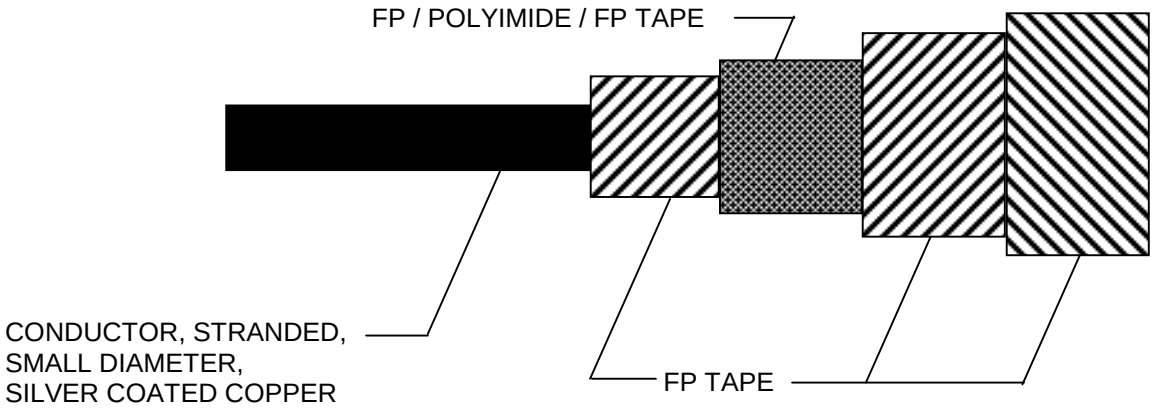

SIZES 4 THROUGH 4/0

FP – Fluorocarbon Polymer, modified Polytetrafluoroethylene (PTFE)

FIGURE 1. General configuration.

1 SCOPE

1.1 Scope. This drawing covers the performance characteristics for a composite wire using a seamless polytetrafluoroethylene/polyimide tape wrap insulation system, with a normal weight stranded conductor. The polyimide tape shall be hydrolysis resistant.

1.2 Part or Identifying Number (PIN). The complete PIN shall be as specified on the requirements drawing and constructed using the following format:

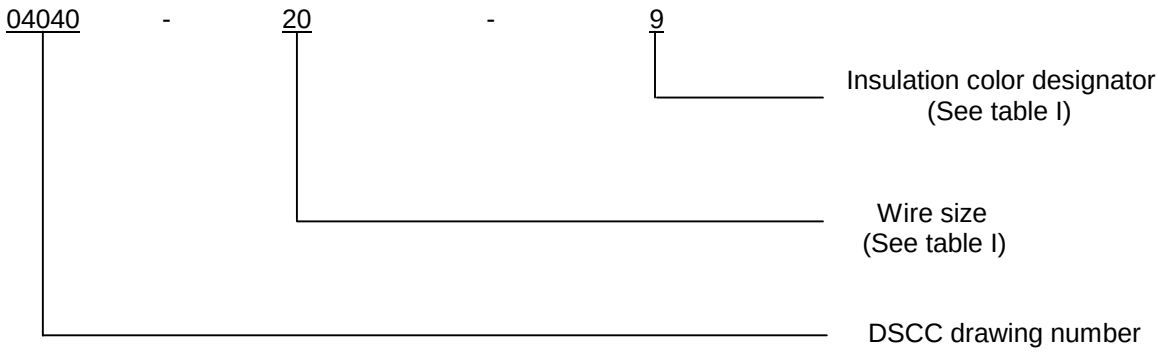

TABLE I. Details of construction.

PIN	Wire size (AWG)	Conductor			Finished wire			
		Stranding (number of strands X gauge (AWG) of strands)	Diameter (inches)		Resistance At 20°C ohms/1000ft (max)	Diameter (inches)		Weight lb/1000ft. (max)
			Min	Max		Min	Max	
04040-26-*	26	19 X 38	.0175	.0194	38.4	.033	.037	1.55
04040-24-*	24	19 X 36	.0225	.0244	24.3	.038	.042	2.20
04040-22-*	22	19 X 34	.0285	.0304	15.1	.043	.047	3.00
04040-20-*	20	19 X 32	.0365	.0384	9.19	.051	.055	4.55
04040-18-*	18	19 X 30	.0455	.0484	5.79	.061	.065	6.70
04040-16-*	16	19 X 29	.0515	.0544	4.52	.068	.073	8.60
04040-14-*	14	19 X 27	.0645	.0684	2.88	.081	.086	12.95
04040-12-*	12	37 X 28	.0835	.0874	1.90	.100	.105	20.1
04040-10-*	10	37 X 26	.106	.110	1.19	.122	.127	31.4
04040-8-*	8	133 X 29	.158	.166	.658	.180	.188	57.6
04040-6-*	6	133 X 27	.198	.208	.418	.219	.229	88.3
04040-4-*	4	133 X 25	.250	.263	.264	.276	.288	143
04040-2-*	2	665 X 30	.320	.340	.170	.344	.364	223
04040-1-*	1	817 X 30	.366	.380	.139	.388	.408	289
04040-01-*	0	1045 X 30	.395	.425	.108	.420	.450	345
04040-02-*	00	1330 X 30	.440	.475	.085	.475	.505	432
04040-03-*	000	1665 X 30	.500	.540	.068	.530	.560	542
04040-04-*	0000	2109 X 30	.565	.605	.054	.590	.630	681

* The asterisks in the part number column of table I shall be replaced by color code designators (see 1.2.2).
Example: 04040-26-93 is white with an orange stripe.

1.2.1 Color. The wire insulation color shall be indicated by the color designator (see 1.2) and as specified in the contract or purchase order. The insulation color shall be in accordance with MIL-STD-681, System 1, differentiation color coding chassis wiring (3 numbers maximum). For laser marked wires, color limits shall be in accordance with MIL-STD-104, class I, or in accordance with table V of this drawing.

2. APPLICABLE DOCUMENTS

2.1 Government Documents.

2.1 Specifications, standards, and handbook. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-W-22759	-	Wire, Electrical, Fluoropolymer-Insulated, Copper or Copper Alloy
MIL-DTL-22759/86	-	Wire, Electrical, Polytetrafluoroethylene/polyimide Insulated, Normal Weight, Silver Coated, Copper Conductor, 200°C, 600 Volts

STANDARDS

MIL-STD-104	-	Limits For Electrical Insulation Color
MIL-STD-681	-	Identification Coding and Application Of Hookup and Lead Wire
MIL-STD-2223	-	Test Methods for Insulated Electric Wire

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://www.dodssp.daps.mil/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094).

2.2 Other publications. The following documents form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of the documents, which are DOD adopted, shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B298	-	Standard Specification for Silver Coated Soft or Annealed Copper Wire
ASTM D4591	-	Standard Test Method for Determining Temperatures and Heats of Transitions of Fluoropolymers by Differential Scanning Calorimetry

(Copies of these documents are available from http://www.astm.org/ or ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, Pennsylvania, USA 19428-2959.)

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCLS)

NCSL Z540.1	-	Laboratories Calibration and Measuring and Test Equipment

(Copies of these documents are available from http://www.ncsli.org or to National Conference of Standards Laboratories (NCSL), 2995 Wilderness Place, Suite 107, Boulder, CO 80301-5404.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

AS 4373 - Test Methods for Insulated Electric Wire

(Copies of these documents are available from http://www.sae.org/ or SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001).

(Non-Government standards and other publications are normally available from the organizations which prepare or distribute the documents. These documents also may be available in libraries or from other informational services.)

3. REQUIREMENTS

3.1 DSCC requirements. Items described in this drawing shall meet the requirements of MIL-W-22759 and MIL-DTL-22759/86 except as specified herein. Any requirements included in this drawing shall be in addition to, or supersede those requirements included in MIL-W-22759 and MIL-DTL-22759/86. In case of conflict between the requirements in this drawing, MIL-W-22759 and MIL-DTL-22759/86, the requirements of this drawing shall take precedence.

3.2 Design configuration. The design, construction, and physical dimensions shall be as specified in this drawing.

3.2.1 Design documentation. Design documentation shall be retained by the manufacturer, and shall be available upon request for review by the contracting activity, DSCC, or contractor.

3.3 Material:

3.3.1 Conductor: Conductors shall be made of soft annealed copper wire in accordance with ASTM B298 and table I of this drawing. All strands shall be free from lumps, kinks, splits, scarred or corroded surfaces and skin impurities. Strands shall be silver coated. The silver coating shall not be less than 40 microinches (1.02 µm) when tested in accordance with ASTM B298.

3.3.2 Insulation: Polytetrafluoroethylene and Polytetrafluoroethylene/Polyimide tape in accordance with tables II and III.

TABLE II. Wire insulation materials. 1/

Tape code	Thickness Nominal (inches)	Material
1	.0020	.0005 FP/.0010 polyimide/.0005 FP
2	.0010	FP (Skived)
3	.0020	FP (Skived)
4	.0020	FP (Unsintered)
5	.0025	FP (Unsintered)
6	.0030	FP (Unsintered)

1/ Physical properties of PTFE unsintered tape shall be in accordance with MIL-W-22759.

TABLE III. Physical properties of FP/Polyimide/FP tapes.

Tensile strength	19,000 lb/in^2 (average min)
Tensile modulus	350,000 lb/in^2 (average min)
Elongation	40 percent (average min)
Dielectric strength	4,000 volts/mil (average min)
.0005 FP Layer	Distinguishable color (next to conductor)

3.4 Wire construction and physical dimensions. See figure 1 and tables I and IV.

TABLE IV. Tape overlap requirements. 1/

Wire size	Wrap 1			Wrap 2			Wrap 3			Wrap 4			Nominal Wall Thickness (mils)
	Tape code	Percent overlap		Tape code	Percent overlap		Tape code	Percent overlap		Tape code	Percent overlap		
		Min	Max		Min	Max		Min	Max		Min	Max	
26	1	50.5	54.0	4	50.5	54.0	-	-	-	-	-	-	7.4
24	1	50.5	54.0	4	50.5	54.0	-	-	-	-	-	-	7.4
22	1	50.5	54.0	4	50.5	54.0	-	-	-	-	-	-	7.4
20	1	50.5	54.0	4	50.5	54.0	-	-	-	-	-	-	7.4
18	1	50.5	54.0	4	50.5	54.0	-	-	-	-	-	-	7.4
16	1	50.5	54.0	5	50.5	54.0	-	-	-	-	-	-	8.3
14	1	50.5	54.0	5	50.5	54.0	-	-	-	-	-	-	8.3
12	1	50.5	54.0	6	50.5	54.0	-	-	-	-	-	-	9.1
10	1	50.5	54.0	6	50.5	54.0	-	-	-	-	-	-	9.1
8	2	20.5	35	1	50.5	55.0	6	67.0	71.0	-	-	-	13.2
6	2	20.5	35	1	50.5	55.0	6	67.0	71.0	-	-	-	13.2
4	3	20.5	35	1	50.5	55.0	6	50.5	54.0	6	50.5	54.0	16.2
2	3	20.5	35	1	50.5	55.0	6	50.5	54.0	6	50.5	54.0	16.2
1	3	20.5	35	1	50.5	55.0	6	50.5	54.0	6	50.5	54.0	16.2
1/0	3	20.5	35	1	50.5	55.0	6	50.5	54.0	6	50.5	54.0	16.2
2/0	3	20.5	35	1	50.5	55.0	6	50.5	54.0	6	50.5	54.0	16.2
3/0	3	20.5	35	1	50.5	55.0	6	50.5	54.0	6	50.5	54.0	16.2
4/0	3	20.5	35	1	50.5	55.0	6	50.5	54.0	6	50.5	54.0	16.2

1/ Wrap 1 is innermost tape which is in contact with the conductor.

3.5 Performance testing: Wire supplied to this drawing shall be qualified in accordance with MIL-DTL-22759/86 and shall meet any additional requirements of this drawing shall apply.

3.5.1 Wet arc propagation resistance (test required for initial qualification only): When tested in accordance with MIL-STD-2223, Method 3006, the following requirements shall apply:

a. A minimum of 70 wires shall pass the impulse dielectric test of MIL-W-22759.
b. Not more than two wires shall fail the impulse dielectric test in any one bundle.
c. Actual damage to the wire shall be not more than 1.0 inch (25.4 mm) in length in any bundle when measured along the axis.

3.5.2 Solderability (quality conformance test): The conductor shall meet the solderability requirements for stranded conductors in accordance with MIL-STD-202, method 208. The following details shall apply:

a. Unless otherwise specified, five specimens shall be prepared and tested for solderability using Method 208 of MIL-STD-202.
b. The specimens shall be tested without steam aging using a type R flux.

3.5.3 Forced Hydrolysis (test required for initial qualification only): When tested in accordance with SAE AS4373, method 602, the minimum average performance shall be 5000 hours at 70°C. The following details shall apply:

a. Number of specimens: 5.
b. Wire size to be tested: 20 AWG.
c. A specimen is considered failed" when it can no longer pass the dielectric test method of SAE AS4373 method 602.
d. Average the time to failure for all of the specimens evaluated.

3.5.4 Insulation state of sinter (quality conformance test): FP layers shall be evaluated with a Differential Scanning Calorimeter in accordance with ASTM D4591. The FP layers shall meet the following requirements:

a. First Heat: Less than 25 Joules/gram (j/g).
b. Second Heat: Maximum 2 j/g change when compared to first heat.
c. Bonding between FP layers shall be homogenous. No evidence of tape edges or seams shall be present on the outer FP layer when visually examined with the unaided eye. The outer surface will be smooth and free of tape edges at the overlap.

3.5.5 Lamination sealing (quality conformance test). When tested in accordance with AS4373 method 809 at 200°C, there shall be no evidence of tape separation or lifting. There shall be no visible tape ridges that can contribute to tearing of the tape.

3.5.6 Strippability (quality conformance test): There shall be no evidence of separation or elongation of FP layers when stripped with standard hand held tools designed for such use. No evidence of insulation shall be left on the conductor when viewed with the naked eye. The following details shall apply:

a. Test size: 26 AWG to 14 AWG in accordance with ASTM D3032 section 27.
b. Length of insulation slugs shall be .25 inches.
c. The strip force shall be as follows:

Wire size (AWG)	Minimun force	Maximum force
26 - 20	0.25 lbs	6.0 lbs
18 - 14	0.50 lbs	7.0 lbs

3.5.7 Durability (PTFE outer layer) (Test required for initial qualification only). When tested as specified below, the wire shall withstand an average of 100 cycles without failure due to tear or surface cut through of the outer layer. The following details shall apply:

a. Wire size: 22 AWG.
b. Temperature: 23°C.
c. Weight: 300 grams (10.6 oz).
d. Edged abrading rod diameter: .026 inch (0.66 mm) nominal.
e. Test specimens shall be manufactured to emulate the wire construction specified herein, except the polyimide shall be replaced with an aluminum/Mylar film of similar thickness with the conductive (aluminum) side out. The conductive surface is used in a circuit path to determine when the abrading rod has penetrated the PTFE layer.
f. Test method:

(1) Install a .026 inch (0.66 mm) edged abrading rod with the edged surface facing down (perpendicular with the test specimen).
(2) Remove approximately 1 inch (25.4 mm) of insulation from the end of the specimen and connect the circuit detection clip to the exposed conductor.
(3) Apply the appropriate weights to the fixture.
(4) Place the abrading rod on the specimen, ensuring the rod is level and perpendicular to the specimen surface.
(5) Zero the counter on the abrasion tester.
(6) Turn the tester on. The rod will begin to oscillate over the surface of the specimen with an approximate 1 inch (25.4 mm) stroke.
(7) The test will continue until the tester detects continuity between the abrading rod and the conductor.
(8) Record the number of cycles to failure.
(9) Repeat the procedure a minimum of 10 times (100 times preferred) to generate a statistically significant sample.
(10) Average the results.

3.5.8 UV laser marking (test required for initial qualification only). When marked with an ultraviolet (UV) laser source at 1.5 j/cm^2, white FP tape shall have a contrast level of 65 percent minimum average and colored FP tape shall have a 62 percent minimum average. This requirement applies to the outer most FP insulation layer. Non-white insulation colors shall meet the Munsell color limit requirements shown in table V. Contrast level is defined as:

$$CL = \frac{\text{(Reflectance of the background insulation - Reflectance of the laser mark)}}{\text{(Reflectance of the background insulation)}}$$

3.5.9 Color (quality conformance test): Colors shall be in accordance with MIL-STD-104, class 1 except as noted in table V. White is preferred. Conformity of color to the limits of MIL-STD-104 shall not be required after oven exposure.

TABLE V. Munsell color limits for UV laser markable wire.

Color	Hue		Value		Chroma	
	From	To	Min	Max	From	To
Black	2.5RN	2.5RN	7	8.5	N/A	N/A
Blue	5PB	7.5B	7	8	4	6
Green	2.5G	7.5G	7	9	2	6
Red	10RP	5R	7	8	4	6
Yellow	5Y	10Y	8	9	4	6
Brown	2.5YR	7.5R	7	9	2	4
Orange	10R	2.5YR	6	7	8	10
Violet	2.5P	7.5R	7	8	4	8
Gray	Same as black	Same as black	Same as black	Same as black	Same as black	Same as black

3.5.10 Color striping or banding durability (quality conformance test). Colored stripes or bands shall meet the durability of color marking requirements specified in MIL-W-22759. The following shall apply to the durability of color marking test.

a. Weight: 250 grams (8.82 oz).
b. Strokes: 250 strokes (125 cycles).

3.6 Ratings:

3.6.1 Temperature rating: 200°C maximum continuous conductor temperature.

3.6.2 Voltage rating: 600 Vrms at sea level.

3.7 Marking. The finished wire shall be identified by a printed marking applied to the outer surface or the wire. The identification mark shall not be applied by hot stamp marking or other methods which significantly penetrate the insulation. The PIN shall be in accordance with 1.2 herein.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.1.1 Equipment calibration. All test equipment and inspection facilities shall be maintained in accordance with NCSL Z540.1 or equivalent.

4.2 Qualification inspection. The product manufactured under this drawing shall be currently listed on the qualified products list QPL-22759 for wire type MIL-DTL-22759/86. The requirements in paragraph 3.5 shall apply.

4.3 Quality conformance. Quality conformance inspection shall be in accordance with MIL-W-22759, MIL-DTL-22759/86 and 3.5 herein.

4.4 Certification: In order to be certified and listed as an approved source of supply for wire manufactured to this drawing, a manufacturer shall:

a. Agree to make available to DSCC, upon request, all pertinent test data indicating compliance to the tests outlined in MIL-W-22759, MIL-DTL-22759/86, and this drawing.

b. Provide to DSCC-VAI, or its designated agent, upon request, free of change and without obligation, current production samples of the types and quantities requested.

c. Meet one of the following criteria:

(1) Currently be listed on QPL-22759 for at least one wire series (not necessarily the one for which this drawing applies).

(2) Be in current production of the subject part.

4.5 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply (see 6.6).

5 PACKAGING.

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6 NOTES

6.1 Intended use. Wires conforming to this drawing are intended for use when military specifications do not exist for wires that will perform the required function. This drawing is intended to prevent the proliferation of unnecessary duplicate specifications, drawings and stock catalog listings. When a military specification exists and the product covered by this drawing has been qualified for listing on QPL-22759, this drawing will be inactivated.

6.2 Ordering data. The acquisition document should specify the following:

a. Complete PIN (see 1.2).

b. Requirements for delivery of a copy of the quality conformance inspection data for the lot being supplied, if applicable. This data should be supplied with each shipment.

c. Requirements for certificate of compliance, if applicable.

d. Requirements for packaging and packing.

e. (As needed)

6.3 Replaceability. Wires covered by this drawing will replace the same generic wires covered by a contractor-prepared specification or drawing.

6.4 Comments. Comments on this drawing should be directed to DSCC-VAI, Post Office Box 3990, Columbus, Ohio 43218-3990, or e-mail to RectangularConnector@dla.mil, telephone (614) 692-0566, or facsimile (614) 692-6939.

6.5 Certificate of compliance. The certificate of compliance submitted to DSCC-VAI, prior to listing as an approved source of supply, shall state that the manufacturer's product meets the requirements of this drawing.

6.6 Generic test data. Generic test data may be used to satisfy the requirements of 4.3. Generic test data shall be on date coded wire no more than 1 year old when the wire is made of the same material, of the same design, and is made using the same manufacturing processes. The vendor is required to retain the generic data for a period of not less than 3 years from the date of shipment.

6.7 Approved sources of supply. Approved sources of supply are listed herein. Additional sources will be added as they become available. The vendors listed have agreed to the contents of this drawing and a certificate of compliance has been submitted to DSCC-VAI.

DSCC drawing PIN	Vendor CAGE Number	Vendor CAGE Number	Vendor similar PIN 1/
04040-26-*	12814	28427	SMLG26-X
04040-24-*	12814	28427	SMLG24-X
04040-22-*	12814	28427	SMLG22-X
04040-20-*	12814	28427	SMLG20-X
04040-18-*	12814	28427	SMLG18-X
04040-16-*	12814	28427	SMLG16-X
04040-14-*	12814	28427	SMLG14-X
04040-12-*	12814	28427	SMLG12-X
04040-8-*	12814	28427	SMLG8-X
04040-6-*	12814	28427	SMLG6-X
04040-4-*	12814	28427	SMLG4-X
04040-2-*	12814	28427	SMLG2-X
04040-1-*	12814	28427	SMLG1-X
04040-01-*	12814	28427	SMLG01-X
04040-02-*	12814	28427	SMLG02-X
04040-03-*	12814	28427	SMLG03-X
04040-04-*	12814	28427	SMLG04-X

1/ Caution: Parts must be purchased to this DSCC PIN to assure that all performance requirements and tests are met.

* Color code designators in accordance with MIL-STD-681 shall replace the asterisks in the part number column of table. Example: 04040-26-93 is white with an orange stripe.

Vendor CAGE number	Vendor name and address
12814	Thermax/CDT 235 North Freeport Drive Nogales, AZ 85621-2428
28427	Thermax/CDT Barcel Division 2851 Alton Parkway Irvine, CA 92606-5145