

INCH-POUND

MIL-DTL-81381/22A
17 February 2017
SUPERSEDING
MIL-W-81381/22(AS)
5 October 1977

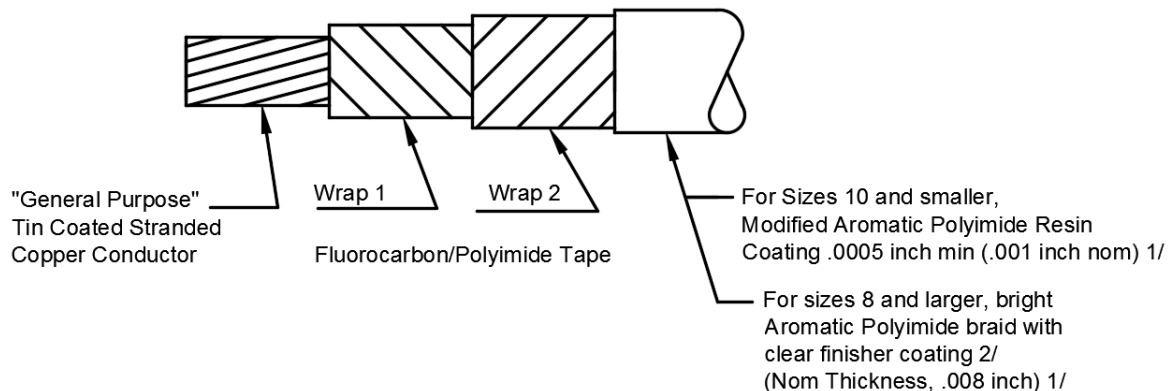
DETAIL SPECIFICATION SHEET

WIRE, ELECTRIC, FLUOROCARBON/POLYIMIDE INSULATED,
MEDIUM WEIGHT, TIN COATED COPPER CONDUCTOR, 600 VOLTS,
150 DEGREES C NOMINAL 8.4 OR 15.4 MIL WALL

Inactive for new design after 16 June 1997. For new design, use
SAE AS22759/188 and SAE AS22759/185 (for AWG size 8 and larger).

This specification is approved for use by all Departments and Agencies
of the Department of Defense.

The requirements for acquiring the product described herein shall consist of this specification sheet and
MIL-DTL-81381.



NOTES:

- 1/ Nominal values are for information only. Nominal values are not requirements.
- 2/ Braid (Sizes 8 and larger): Bright aromatic polyamide yarn, 200 denier, 100 filaments, tightly formed, uniform in appearance, treated with a clear finisher coating. Finisher coating shall be compatible with the 150°C temperature rating and the performance requirements of the insulated wire.

FIGURE 1 - Wire construction.



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TABLE I. Construction details.

Part Identification Number (PIN) 1/	Conductor				Finished Wire				Insulation Tapes			
	Wire Size	Stranding (Number of Strands x AWG Gage of Strands)	Diameter (inches)		Max Resistance at 20° C (ohms/1000 ft.)	Diameter (inches) (min – max)	Weight (lbs/1000 ft.)		Wrap 1		Wrap 2	
			min	max			nom. 2/	max	Tape Code 3/	Min. Overlap	Tape Code 3/	Min. Overlap
M81381/22-24-*	24	19 x 36	.023	.026	26.2	.040-.044	2.1	2.2	0/2/.5	50	.1/1/.1	50
M81381/22-22-*	22	19 x 34	.029	.033	16.2	.045-.049	3.0	3.2				
M81381/22-20-*	20	19 x 32	.037	.041	9.86	.053-.058	4.5	4.7				
M81381/22-18-*	18	19 x 30	.046	.051	6.23	.063-.068	6.7	7.0				
M81381/22-16-*	16	19 x 29	.052	.058	4.81	.068-.074	8.4	8.7				
M81381/22-14-*	14	19 x 27	.065	.073	3.06	.081-.089	13.0	13.3				
M81381/22-12-*	12	37 x 28	.084	.090	2.02	.100-.107	20.0	20.4				
M81381/22-10-*	10	37 x 26	.106	.114	1.28	.122-.130	31.0	31.5				
M81381/22-8-*	8	133 x 29	.158	.173	.701	.188-.206	58.7	61.8			.5/1/.5	50
M81381/22-6-*	6	133 x 27	.198	.217	.445	.228-.251	90.4	95.1				
M81381/22-4-*	4	133 x 25	.250	.274	.280	.280-.306	141	148				
M81381/22-2-*	2	665 x 30	.320	.340	.183	.350-.378	224	235				
M81381/22-01-*	0	1045 x 30	.395	.425	.116	.425-.461	356	374				
M81381/22-02-*	00	1330 x 30	.440	.475	.091	.478-.518	447	470				

1/ PIN: The asterisks in the PIN column of Tables I and II shall be replaced by color code designators in accordance with MIL-STD-681, except that opaque dark yellow as defined in MIL-DTL-81381 shall be designated by the letter "N" and unpigmented polyimide resin coating shall be designated by the letter "C". Examples: Size 20, opaque dark yellow – M81381/22-20-N, same with orange stripe – M81381/22-20-N3. A non-white insulation may be used with striping or banding (certain color combinations with low color contrast can make identification difficult or increase the chance of misidentification).

2/ Nominal values are for information only. Nominal values are not requirements.

3/ Tape Codes:

0/2/.5 2 mil polyimide film/0.5 mil FEP fluorocarbon resin
.1/1/.1 0.1mil FEP fluorocarbon resin/1 mil polyimide film/0.1 mil FEP fluorocarbon resin
.5/1/.5 0.5mil FEP fluorocarbon resin/1 mil polyimide film/0.5 mil FEP fluorocarbon resin

FEP = Fluorinated Ethylene Propylene

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TABLE II. Performance details.

Part or Identification Number (PIN)	Durability Test Load for		Abrasion Resistance				Bend Testing					
	Color Markings (grams)	Insulation Coatings (lbs)	Weight Support Bracket	Weight (lbs)	Tension Load (lbs)	Resistance (inches of tape) (min)	Mandrel diameter (inches) (±3%)				Test Load (lbs) (±3%)	
							Life Cycle (Oven & bend tests) <u>2/</u>	Cold Bend Test	Wrap Test	Wrinkle Test	Life Cycle (Oven & bend tests) <u>2/</u>	Cold Bend Test
M81381/22-24-*	75	.75	A	1.0	1.0	12	.250	.250	.125	.156	.500	
M81381/22-22-*	100	1.00				14				.188	.750	
M81381/22-20-*						16				.250		
M81381/22-18-*	150					1.00	20	.375	.375	.312	1.00	
M81381/22-16-*										.375		
M81381/22-14-*			B	24	.500		.250	.500	2.00			
M81381/22-12-*		26		.750	.750		.375	.750				
M81381/22-10-*							1.00	3.00				
M81381/22-8-*	<u>1/</u>	C	4.25	2.0	18	2.00	2.00		1.00	1/	8.00	
M81381/22-6-*					27	4.50	4.50		2.00			
M81381/22-4-*						6.00	6.00		3.00			
M81381/22-2-*									4.00			
M81381/22-01-*					30	8.00	8.00	6.00	10.00			10.00
M81381/22-02-*												

1/ Test not applicable.

2/ Also for bend tests after immersion

WIRE RATINGS AND ADDITIONAL REQUIREMENTS

Temperature rating: 150° C (302° F) max conductor temperature

Voltage rating: 600 volts (RMS) at sea level

Blocking: Oven temperature, 200 ±2° C (392 ±3.6° F)

Braid fraying: The aromatic polyamide braid with finisher (wire sizes 8 and larger) shall be non-fraying and shall firmly adhere to the underlying insulation. This examination shall be included in the MIL-DTL-81381 quality conformance inspection as a Group II characteristic, one specimen to be examined from each sample unit.

Color: Sizes 20 through 10: As specified in contract or order in accordance with MIL-DTL-81381
 Sizes 8 through 00: The natural color of the finisher-treated aromatic polyamide braid (off-white to amber is preferred (color designator "C"). Other colors, varying with the supplier, are available. The MIL-STD-104 color limits and the extended color limits of MIL-DTL-81381 are not applicable to these sizes.

Conductor strand adhesion: Sizes 26 through 14 (Qualification and quality conformance requirement): Conductors taken from wire in "as received" condition shall have a minimum of count of 13 when examined for conductor strand adhesion by the procedure described below sheet. In quality conformance inspection, conductor strand adhesion shall be a Group II characteristic, one specimen to be examined from each sample unit. Sizes 12 and 00 (Qualification requirement only): Conductors taken from wire in "as received" condition, when examined by the qualifying activity, shall show a total count of unbonded single strand and metallic-bonded pairs or groups of strands which shall be not less than 70% of the total number of strands in the conductor.

Examination for Conductor Strand Adhesion (19-Strand Conductor Count as Example)

The specimen shall be a six-inch length of finished wire in initial or "as received condition. With an insulation stripping tool, initiate a stripping action two inches from one end of the specimen, without kinking or otherwise damaging the conductor, and move the insulation slug endwise until

approximately $\frac{3}{4}$ inch of the conductor is exposed. Remove the specimen from the stripping tool and proceed as follows for unidirectional or "true concentric" lay conductor as applicable.

A. For unidirectional lay

- (a) Grip the insulation with the fingers at both ends of the exposed portion of the conductor and rotate one end of the specimen so as to untwist the exposed strands and make them parallel with the conductor axis. The use rubber pads or similar holding aids is permitted.
- (b) Retain the grip position used to untwist the strands and carefully push the ends of the exposed portion of the conductor toward each other in the conductor axis causing the strands to spread apart in a "bird cage" effect.
- (c) Gently probe unseparated strands with a fine needle or thin blade to determine whether they are fused together by metallic bonding or simply lying side by side. Metallic-bonded pairs or groups of strands which cannot be separated along the whole "bird cage" length, without forcing the needle or blade between the strands, shall each be counted as one in step (d).
- (d) Count the number of unbonded single strands plus the number of metallic-bonded pairs or groups of strands in the conductor.

B. For "true concentric" lay

- (a) Perform step (a) as for unidirectional lay, but use only the rotation needed to untwist the 12-strand outer layer.
- (b) Perform step (b) as for unidirectional lay, using the pressure needed to "bird cage" the outer layer.
- (c) On the "bird caged" outer layer, perform step (c) as for unidirectional lay.
- (d) On the "bird caged" outer layer, perform step (d) as for unidirectional lay.
- (e) Using a suitable tool, snip through each unbonded single strand and each bonded pair or bonded group of strands of the outer layer approximately in the center of the "bird cage" and fold the snipped ends back toward the respective ends of the specimen. Do not cut the 7-strand core of the conductor.
- (f) Repeat steps (a), (b), (c), and (d) with the 7-strand core.
- (g) Add the count of unbonded single strands and bonded pairs and bonded groups of strands in the core to the count previously derived from the outer layer. This is the count applicable to the entire 19-strand conductor.

Interpretation of results – For a 19-strand conductor, whether unidirectional or "true concentric lay, the count of unbonded single strands plus the count of metallic-bonded pairs or groups of strands in the conductor shall not be less than the minimum total count specified in the applicable specification or specification sheet.

Flammability: 3 sec (max) after flame
3 inches (max) flame travel
No flaming of tissue paper

Humidity Resistance: 5 megohms-1000 ft, min insulation resistance after humidity exposure

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Identification of product: Required for sizes 22 AWG and larger

Identification, striping, or banding durability: 125 cycles (250 strokes) (min); see Table II for test load

Impulse dielectric test: 100% test; impulse voltage as specified in MIL-DTL-81381

Insulation resistance: 2500 megohm-1000 ft. (min)

Lamination sealing: Oven temperature $230 \pm 2^\circ \text{C}$ ($446 \pm 3.6^\circ \text{F}$)

Life cycle: Oven temperature $230 \pm 2^\circ \text{C}$ ($446 \pm 3.6^\circ \text{F}$) for 500 hours (Darkening of the tin coating of the conductor due to normal air oxidation shall not be cause for rejection in this test.)

Minimum wall thickness: Sizes 24 through 10: 8.0 mils

Sizes 8 through 00: 15.0 mils

Polyimide cure test: Applicable to sizes 10 and smaller

Propellant resistance: Test not required

Resin coating durability:	Sizes 24 through 10:	250 cycles (500 strokes); see Table II for test load
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Sizes 8 through 00: Test not applicable

Shrinkage: 0.031 inches (max) at 230±2° C (446±3.6° F)

Surface resistance: 5 megohms-inches (min), initial and final readings

Thermal shock: Oven temperature, $150 \pm 2^{\circ}\text{C}$ ($302 \pm 3.6^{\circ}\text{F}$), Change in measurement: 0.031 inches (max)

Wet dielectric test: 2500 volts (RMS)

Wrinkle test: Applicable to sizes 10 and smaller. No wrinkles shall be visible in the insulation at 3X magnification (3 diameters) after bending the wire one full turn around the mandrel specified in Table II (The wire may be examined on the mandrel or after removal of the mandrel leaving the coal intact.) This test shall be included in the MIL-DTL-81381 quality conformance inspection as Group II characteristic, one specimen to be tested from each sample unit.

This wire should not be subjected to hypergolic propellants.

Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Referenced document. In addition to the basic specification MIL-DTL-81381, this document references:

MIL-STD-681

MIL-STD-104

SAE AS22759/185

SAE AS22759/188

CONCLUDING MATERIAL

Custodians:

Navy - AS

DLA - IS

Preparing activity:

DLA - CC

(Project 6145-2016-061)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.