MILITARY SPECIFICATION SHEET

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

This specification sheet is approved for use by the Naval Air Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

The complete requirements for procuring the wire described herein shall consist of this document and the issue in effect of Specification MIL-W-81381.

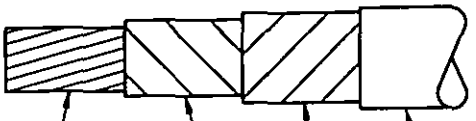

TABLE I. Construction details.

Part Number 1/	Wire Size	Conductor			Finished Wire				Insulation Tapes			
		Stranding (Number of Strands X AWG gage of strands)	Diameter (inches)		Resistance at 20°C (68°F) (ohms/1000 ft) (max)	Diameter (inches) (min-max)	Weight (lbs/1000 ft)		Wrap 1		Wrap 2	
			(min)	(max)			(nom) 2/	(max)	Tape Code 3/	Overlap(%) (min)	Tape Code 3/	Overlap(%) (min)
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	9.88	.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/ Part Number: The asterisks in the part number column, 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-W-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.

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

FEP = Fluorinated Ethylene Propylene

4/ 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.

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TABLE II. Performance details.

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

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-W-81381 quality conformance inspection as a Group II characteristic, one specimen to be examined from each sample unit.
COLOR: Sizes 24 through 10: As specified in contract or order in accordance with MIL-W-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-W-81381 are not applicable to these sizes.
CONDUCTOR STRAND ADHESION: Sizes 24 through 14 (Qualification and quality conformance requirement): Conductors taken from wire in "as received" condition shall exhibit a count of 13 minimum when examined for conductor strand adhesion by the procedure described on page 3 of this specification 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 through 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 strands and metallic-bonded pairs or groups of strands which shall be not less than 70% of the total number of strands in the conductor.
FLAMMABILITY: 3 sec (max) after-flame
3.0 inches (max) flame travel
No flaming of tissue paper
HUMIDITY RESISTANCE: 5 megohms-1000 ft, min insulation resistance after humidity exposure
IDENTIFICATION OF PRODUCT: Required for sizes 22 and larger
IDENTIFICATION, STRIPING, OR BANDING DURABILITY: 125 cycles (250 strokes); see Table II for test load.
IMPULSE DIELECTRIC TEST: 100% test; impulse voltage as specified in MIL-W-81381
INSULATION RESISTANCE: 2500 megohms-1000 ft (min)
LAMINATION SEALING: Oven temperature, 230 ±2°C (446 ±3.6°F)
LIFE CYCLE: Oven temperature, 230 ±2°C (446 ±3.6°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.
Sizes 8 through 00: Test not applicable
SHRINKAGE: 0.031 inch (max) at 230 ±2°C (446 ±3.6°F)
SURFACE RESISTANCE: 5 megohms-inches (min), initial and final readings
THERMAL SHOCK: Oven temperature, 150 ±2°C (302 ±3.6°F) change in measurement, 0.031 inch (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 coil intact.) This test shall be included in the MIL-W-81381 quality conformance inspection as a Group II characteristic, one specimen to be tested from each sample unit.

Caution: This wire should not be subjected to physical contact with missile propellants.

Examination for Conductor Strand Adhesion (19-strand Conductor)

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 and, without kinking or otherwise damaging the conductor, move the insulation slug endwise until approximately 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 of 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), (d) On the "bird caged" outer layer, perform steps (c) and (d) as for unidirectional lay.

(e) Using a suitable tool, snip through each unbonded single strand and each bonded pair or 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 or groups of strands in the core to the count previously derived from the outer layer. This total is the count applicable to the entire 19-strand conductor.

C. 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 be not less than the minimum total count specified in the applicable specification or specification sheet.

Preparing activity:
Navy - AS
(Project No. 6145-N273-2)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

b. ADDRESS *(Street, City, State, ZIP Code)*

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional

b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional

c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional

8. DATE OF SUBMISSION *(YYMMDD)*

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