REVISIONS

SYMBOL	PREP BY	DESCRIPTION	DATE	APPROVAL
A	TJP	Retyped with revisions to update paras. and tables to conform with the manufacturer's specifications. Basic requirements remain unchanged.	5/01/90	GFK 5/18/90

PREPARED BY T. J. PERRY/UNISYS CORP. T J Perry	DATE 5/01/90	TITLE Wire, Electrical, Radiation Crosslinked Polyalkene Insulated, Tin-Coated Copper, 1000 Volt, For Space Flight Use, Detail Specification For
APPROVED G. F. KIERNAN/UNISYS CORP. Gerard F Kiernan	5/18/90	
APPROVED S. A. NAUS/GSFC Stan A. Naus	6-14-90	
APPROVED D. G. CLEVELAND/GSFC D G Cleveland	6/14/90	
		# S-311-P-13/2

OFFICE OF FLIGHT ASSURANCE
PARTS BRANCH

NASA
National Aeronautics and
Space Administration

GSFC
Goddard Space Flight Center
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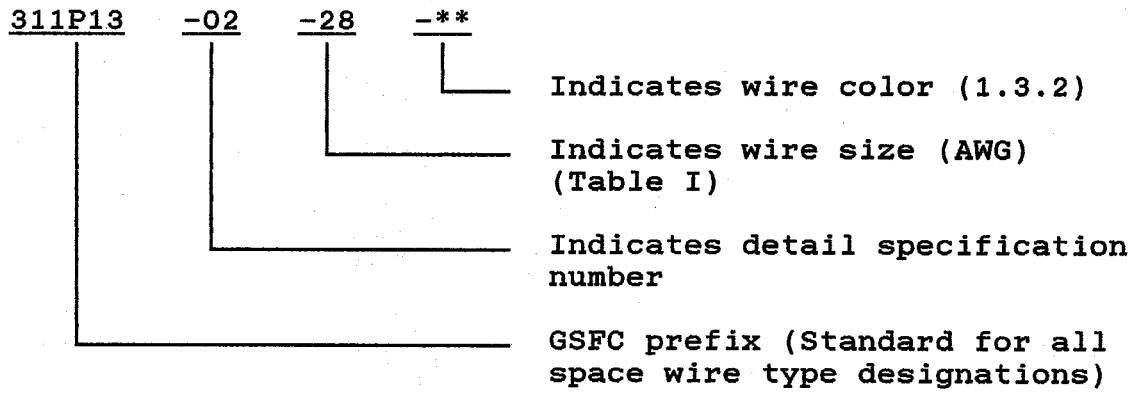
20771

1. SCOPE

1.1 PURPOSE - This detail specification covers the provisions for electrical wire with radiation crosslinked polyalkene insulation and having a tin-coated copper conductor. The wire covered by this specification has a voltage rating of 1000 volts (rms) and a maximum conductor temperature rating of 135°C (275° F) (3.2.22).

1.2 GSFC GENERAL SPECIFICATION - Unless otherwise noted, all finished wire provisions and requirements of GSFC general specification S-311-P-13 apply to this specification (2.2).

1.3 WIRE TYPE DESIGNATIONS - Wire shall be ordered by the following type designations:



1.3.1 Wire Size - Select the wire size from Table I.

1.3.2 Wire Color - Replace ** in the type designation with a color code designator in accordance with MIL-STD-681.

Examples: Size 28, white: 311P13-02-28-9
Size 28, white w/black stripe: 311P13-02-28-90

2. APPLICABLE DOCUMENTS (1.2) - The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

2.1 SPECIFICATIONS

2.1.1 National Aeronautics and Space Administration (NASA)

GSFC S-311-P-13..Wire and Cable, Electrical, Insulated, for Space Flight Use, General Specification for

2.2 ORDER OF PRECEDENCE - The order of precedence delineated in the general specification shall apply.

3. REQUIREMENTS (1.2)

3.1 MATERIALS AND CONSTRUCTION - Wire shall be of the materials, construction, and physical dimensions as specified herein (Table I and Figure 1).

Table I - Construction Details

Type Designation	Wire Size (AWG)	Conductor Stranding (No. X AWG)	Maximum Diameter Stranded Conductor (Inches)	Finished Wire Diameter (Inches)	Maximum Weight (Lbs./ 1000 Ft.)
311P13-02-28-**	28	7 X 36	.016	.032±.002	1.2
311P13-02-26-**	26	7 x 34	.021	.039±.002	1.7
311P13-02-24-**	24	19 X 36	.026	.044±.002	2.6
311P13-02-22-**	22	19 X 34	.033	.051±.002	3.6
311P13-02-20-**	20	19 X 32	.041	.059±.002	5.2
311P13-02-18-**	18	19 X 30	.052	.071±.003	7.5
311P13-02-16-**	16	19 X 29	.060	.079±.003	9.4
311P13-02-14-**	14	19 X 27	.074	.094±.004	14.2
311P13-02-12-**	12	19 X 25	.092	.123±.004	24.0
311P13-02-10-**	10	37 X 26	.118	.137±.005	33.2
311P13-02- 8-**	8	133 X 29	.176	.198±.010	62.6

3.1.1 Jacket - The jacket shall be in accordance with Figure 1 and shall have a thickness as specified.

Wire Size (AWG)	Jacket Thickness (Inches)
28 - 10	.004 ± .001
8	.005 ± .001

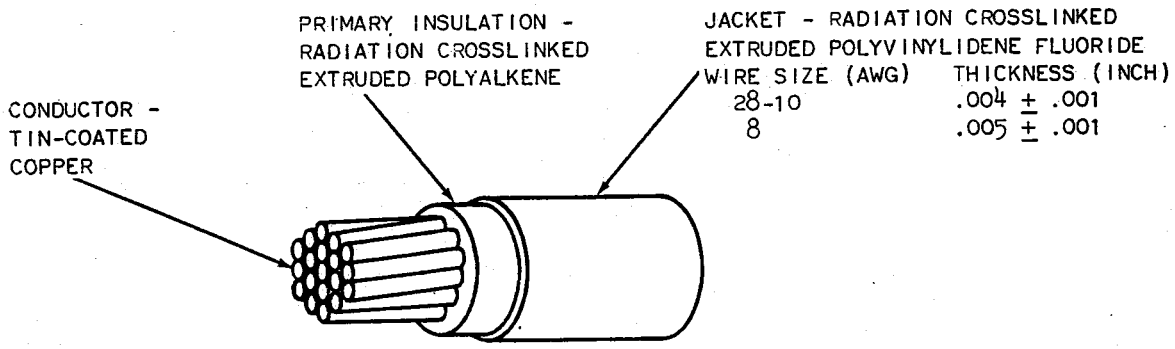


Figure 1 - Construction of Finished Wire

3.1.2 Material Weight Loss (Vacuum) - Wire materials used shall be such that in no case will the outgassing limits of 3.2.21 be exceeded when tested in accordance with GSFC S-311-P-13.

3.2 INSPECTION - Inspection shall be in accordance with GSFC S-311-P-13 and the following requirements.

3.2.1 Insulation Tensile Strength and Elongation - The primary insulation tensile strength shall be as specified. The elongation shall be 150% (minimum).

Wire Size (AWG)	Tensile Strength (psi)
28 - 10	2500 (minimum)
8	2000 (minimum)

3.2.2 Insulation Flaws (Spark Test) - The insulation flaws test shall be conducted on 100% of the wire at the following conditions:

Primary Insulation - 2000 volts (rms), 60 Hz

3.2.3 Blocking - The applicable temperature for the blocking requirement is 150 ± 3°C (302 ± 5°F).

3.2.4 Impulse Dielectric Test - The impulse dielectric test shall be conducted on 100% of the wire at the following conditions:

Primary Insulation - 6000 volts (peak)
Finished Wire
Qualification - 8000 volts (peak)
Quality Conformance - 11000 volts (peak)

3.2.5 Finished Wire Insulation Resistance - The insulation resistance shall be 5000 megohms for 1000 feet (minimum).

3.2.6 Conductor Resistance - The conductor resistance shall be as specified in Table II.

3.2.7 Shrinkage - Shrinkage shall be 1/8 inch (maximum) in 12 inches when the test is conducted at 225 ± 3°C (437 ± 5°F). This requirement applies to wire sizes 28 through 10 only.

3.2.8 Wicking - The distance of wicking shall not exceed 1/2 inch.

3.2.9 Wet Dielectric Strength - The wet dielectric strength test shall be conducted after accelerated aging, immersion, life cycle, low temperature (cold

bend), and radiation resistance, as specified, at 3000 volts (rms), 60 Hz.

Table II - Conductor Resistance

Wire Size (AWG)	Maximum Resistance at 20°C (68°F) (Ohms per 1000 Feet)
28	68.6
26	42.5
24	26.2
22	16.2
20	9.88
18	6.23
16	4.81
14	3.06
12	2.02
10	1.26
8	.701

3.2.10 Life Cycle - The air circulating oven shall be maintained at a temperature of 200 ± 3°C (392 ± 5°F). The mandrel diameter and test load shall be as specified in Table III.

Table III - Bend Testing

	Mandrel Diameter (Inches, Max.)				Test Load (Lbs.)	
Wire Size (AWG)	Life Cycle, Immersion, and Accelerated Aging Tests	Cold Bend Test	Wrap Test	Radiation Resistance Test	Life Cycle, Immersion and Accelerated Aging Tests	Cold Bend Test
28	1/2	1/2	1/4	3/4	.13	0.5
26	3/4	1/2	3/8	1	.19	0.5
24	3/4	3/4	3/8	1	.19	1.0
22	1	3/4	1/2	1-1/4	.19	1.0
20	1	1	1/2	1-1/2	.25	1.0
18	1	1	1/2	1-1/2	.25	1.0
16	1-1/2	1-1/2	3/4	1-3/4	.50	3.0
14	1-1/2	1-1/2	3/4	2-1/2	.50	3.0
12	3	3	1	3	1.00	5.0
10	3	3	1	3-1/2	1.00	5.0
8	3	3	1-1/2	4	1.50	5.0

3.2.11 Accelerated Aging - The air circulating oven shall be maintained at a temperature of 225 ± 3°C (437 ± 5°F). The mandrel diameter and test load shall be as specified in Table III.

3.2.12 Low Temperature (Cold Bend) - The mandrel diameter and test load shall be as specified in Table III. There shall be no cracks in the insulation or dielectric breakdown after the cold bend test.

3.2.13 Wrap Test - The wrap test shall be conducted with a mandrel diameter as specified in Table III.

3.2.14 Radiation Resistance - The radiation resistance test shall be conducted using a maximum radiation of 500 megarads. The mandrel diameter shall be as specified in Table III.

3.2.15 Flammability - The distance of flame travel upward along the wire from the test mark shall not exceed three inches. The time of burning after removal of the flame shall not exceed 30 seconds. There shall be no flaming of the tissue paper.

3.2.16 Humidity Resistance - The insulation resistance of the specimen after the humidity cycling shall be 5000 megohms for 1000 feet (minimum).

3.2.17 Surface Resistance - The surface resistance shall be 500 megohm-inches (minimum) for both measurements.

3.2.18 Smoke - The conductor temperature shall be maintained at 165 ± 3°C (329 ± 5°F) during which time there shall be no visible smoke.

3.2.19 Color Striping Durability - The number of abrading cycles shall be 125 (250 strokes) minimum.

3.2.20 Immersion Tests - The mandrel diameter and test load for the bend test after immersion shall be as specified in Table III.

3.2.21 Vacuum Effects (Material Outgassing) - Material outgassing shall not exceed the following limits:

Total Weight Loss -	1.0 percent
Volatile Condensable Material -	0.1 percent

3.2.22 Temperature Rating - The temperature rating shall be as specified in 1.1.

4. QUALITY ASSURANCE PROVISIONS - All wire procured to this specification shall be inspected as specified in GSFC S-311-P-13.

5. PREPARATION FOR DELIVERY (1.2)

6. NOTES (1.2)

Custodian:

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