POLYIMIDE INSULATED WIRES AND CABLES,

LOW FREQUENCY, 600V, -100 TO +150 °C

ESCC Detail Specification No. 3901/006

ISSUE 1

October 2002

Document Custodian: European Space Agency - see https://escies.org

LEGAL DISCLAIMER AND COPYRIGHT

european space agency
agence spatiale européenne

Pages 1 to 20

POLYIMIDE INSULATED WIRES AND CABLES,

LOW FREQUENCY, 600V, −100 TO +150 °C

ESA/SCC Detail Specification No. 3901/006

SCC

space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 3	January 1996		

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 2 and incorporates the changes agreed in the following DCR's:-		
		Cover Page		None
		DCN		None
		Para 4.2.4	: Title amended	23791
		Para. 4.3.1	: Wording amended	23791
		Para 4.4.1.1	: Paragraph standardised	23791
		Para 4.4.1.2	: Paragraph standardised	23791
		Para 4.5.2	: Wording amended	23791
		Para 4.5.5	: Wording amended	23791
		Para 4.8.2	: Sentence added	23791
		Para 4.8.3	: Sentence added	23791
		Para 4.8.7	: Sentence added	23791
		Para 4.8.11	: Test '(h)' and '(i)' corrected to '(e)' and '(f)'	23791
		Para 4.8.18	: Original paragraph deleted and Para 4.8.19 renumbered to 4.8.18	23791
		Para 4.8.19	: New paragraph added	23791

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES (Applicable to specific Manufacturers only)
None.

1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Polyimide Insulated Wires and Cables, Low Frequency, 600V, −100 to +150 °C. It shall be read in conjunction with ESA/SCC Generic Specification No. 3901, the requirements of which are supplemented herein.

NOTES

1. These wires and cables shall not be used in the presence or vicinity of hydrazine or nitrogen tetroxide.

1.2 TYPE VARIANTS

Variants of the basic types of wires and cables specified herein which are also covered by this specification, are listed in Table 1(a).

1.3 MAXIMUM RATINGS

The maximum ratings, applicable to the finished wires and cables specified herein, which shall not be exceeded at any time during use or storage in controlled space environment, are scheduled in Table 1(b).

1.4 PARAMETER DERATING INFORMATION

The derating information applicable to the finished wires and cables specified herein is as follows:

- The maximum current for each wire used in a bundle shall be:-

$$I_{Bmax} = I_{max} \times \frac{29 - n}{28} \quad (\text{for } 1 < n < 15)$$

$$I_{Bmax} = \frac{I_{max}}{2} \quad (\text{for } n > 15)$$

where n = number of wires in the bundle;

- The temperature derating information is shown in Figure 1 with maximum current I_{max} for a single wire.

- The derating factors contained herein indicate maximum stress values and do not preclude further derating.

1.5 PHYSICAL CHARACTERISTICS

The physical characteristics of the finished wires and cables specified herein are shown in Figures 2(a), 2(b) and 2(c) and their dimensions in Table 1(a).

1.6 FUNCTIONAL DIAGRAM

Not applicable.

TABLE 1(a) - TYPE VARIANTS

VARIANT No.	SHIELDED	UN-SHIELDED	No. OF CORES	WIRE SIZE AWG	STRANDING No. OF STRANDS x DIAMETER (mm)	CONDUCTOR CHARACTERISTICS			SHIELD STRAND Ø (mm)	CORE MAX Ø (mm)	FINISHED WIRE OR CABLE CHARACTERISTICS		
						MAX Ø (mm)	NOM SECT. (mm^2)	MAX OHMIC RESISTANCE (Ω/km)			MIN Ø (mm)	MAX Ø (mm)	MAX WEIGHT (kg/km)
01		X	1	26	19×0.10 (1)	0.53	0.15	160	-	-	0.66	0.78	1.90
02		X	1	24	19×0.12 (1)	0.62	0.21	114	-	-	0.76	0.88	2.60
03		X	1	22	19×0.16	0.85	0.38	52.7	-	-	0.96	1.08	4.25
04		X	1	20	19×0.20	1.04	0.60	33.2	-	-	1.14	1.28	6.45
05		X	1	18	19×0.25	1.29	0.93	21.1	-	-	1.39	1.53	9.50
06		X	2	26	19×0.10 (1)	0.53	0.15	168	-	0.78	-	1.64	4.25
07		X	2	24	19×0.12 (1)	0.62	0.21	120	-	0.88	-	1.84	5.70
08		X	2	22	19×0.16	0.85	0.38	55.4	-	1.08	-	2.24	9.0
09		X	2	20	19×0.20	1.04	0.60	34.9	-	1.28	-	2.64	13.5
10		X	2	18	19×0.25	1.29	0.93	22.2	-	1.53	-	3.15	21.0
11		X	3	26	19×0.10 (1)	0.53	0.15	168	-	0.78	-	1.76	6.10
12		X	3	24	19×0.12 (1)	0.62	0.21	120	-	0.88	-	1.97	8.30
13		X	3	22	19×0.16	0.85	0.38	55.4	-	1.08	-	2.40	13.6
14		X	3	20	19×0.20	1.04	0.60	34.9	-	1.28	-	2.84	20.1
15		X	3	18	19×0.25	1.29	0.93	22.2	-	1.53	-	3.40	31.0
16	X		1	26	19×0.10 (1)	0.53	0.15	160	0.08	0.78	-	1.14	4.0
17	X		1	24	19×0.12 (1)	0.62	0.21	114	0.08	0.88	-	1.24	4.80
18	X		1	22	19×0.16	0.85	0.38	52.7	0.08	1.08	-	1.44	7.10
19	X		1	20	19×0.20	1.04	0.60	33.2	0.08	1.28	-	1.64	9.65
20	X		1	18	19×0.25	1.29	0.93	21.1	0.10	1.53	-	1.95	14.2

NOTES: 1. Copper alloy.
2. With core identification as defined in Para. 4.4.3.2.

TABLE 1(a) - TYPE VARIANTS (CONTINUED)

VARIANT No.	SHIELDED	UN-SHIELDED	No. OF CORES	WIRE SIZE AWG	STRANDING No. OF STRANDS x DIAMETER (mm)	CONDUCTOR CHARACTERISTICS			SHIELD STRAND Ø (mm)	CORE MAX Ø (mm)	FINISHED WIRE OR CABLE CHARACTERISTICS		
						MAX Ø (mm)	NOM SECT. (mm^2)	MAX OHMIC RESISTANCE (Ω/km)			MIN Ø (mm)	MAX Ø (mm)	MAX WEIGHT (kg/km)
21	X		2	26	19×0.10 (1)	0.53	0.15	168	0.08	0.78	-	1.95	7.0
22	X		2	24	19×0.12 (1)	0.62	0.21	120	0.10	0.88	-	2.18	9.30
23	X		2	22	19×0.16	0.85	0.38	55.4	0.10	1.08	-	2.59	13.7
24	X		2	20	19×0.20	1.04	0.60	34.9	0.10	1.28	-	2.97	18.8
25	X		2	18	19×0.25	1.29	0.93	22.2	0.12	1.53	-	3.58	28.0
26	X		3	26	19×0.10 (1)	0.53	0.15	168	0.10	0.78	-	2.09	10.1
27	X		3	24	19×0.12 (1)	0.62	0.21	120	0.10	0.88	-	2.30	12.7
28	X		3	22	19×0.16	0.85	0.38	55.4	0.10	1.08	-	2.73	18.9
29	X		3	20	19×0.20	1.04	0.60	34.9	0.12	1.28	-	3.25	28.0
30	X		3	18	19×0.25	1.29	0.93	22.2	0.15	1.53	-	3.86	42.0
31 (2)		X	2	26	19×0.10 (1)	0.53	0.15	168	-	0.78	-	1.64	4.25
32 (2)		X	2	24	19×0.12 (1)	0.62	0.21	120	-	0.88	-	1.84	5.70
33 (2)		X	2	22	19×0.16	0.85	0.38	55.4	-	1.08	-	2.24	9.0
34 (2)		X	2	20	19×0.20	1.04	0.60	34.9	-	1.28	-	2.64	13.5
35 (2)		X	2	18	19×0.25	1.29	0.93	22.2	-	1.53	-	3.15	21.0
36 (2)		X	3	26	19×0.10 (1)	0.53	0.15	168	-	0.78	-	1.76	6.10
37 (2)		X	3	24	19×0.12 (1)	0.62	0.21	120	-	0.88	-	1.97	8.30
38 (2)		X	3	22	19×0.16	0.85	0.38	55.4	-	1.08	-	2.40	13.6
39 (2)		X	3	20	19×0.20	1.04	0.60	34.9	-	1.28	-	2.84	20.1
40 (2)		X	3	18	19×0.25	1.29	0.93	22.2	-	1.53	-	3.40	31.0

NOTES: 1. Copper alloy.
2. With core identification as defined in Para. 4.4.3.2.

TABLE 1(a) - TYPE VARIANTS (CONTINUED)

VARIANT No.	SHIELDED	UN-SHIELDED	No. OF CORES	WIRE SIZE AWG	STRANDING No. OF STRANDS x DIAMETER (mm)	CONDUCTOR CHARACTERISTICS			SHIELD STRAND Ø (mm)	CORE MAX Ø (mm)	FINISHED WIRE OR CABLE CHARACTERISTICS		
						MAX Ø (mm)	NOM SECT. (mm^2)	MAX OHMIC RESISTANCE (Ω/km)			MIN Ø (mm)	MAX Ø (mm)	MAX WEIGHT (kg/km)
41 (2)	X		2	26	19×0.10 (1)	0.53	0.15	168	0.08	0.78	-	1.95	7.0
42 (2)	X		2	24	19×0.12 (1)	0.62	0.21	120	0.10	0.88	-	2.18	9.30
43 (2)	X		2	22	19×0.16	0.85	0.38	55.4	0.10	1.08	-	2.59	13.7
44 (2)	X		2	20	19×0.20	1.04	0.60	34.9	0.10	1.28	-	2.97	18.8
45 (2)	X		2	18	19×0.25	1.29	0.93	22.2	0.12	1.53	-	3.58	28.0
46 (2)	X		3	26	19×0.10 (1)	0.53	0.15	168	0.10	0.78	-	2.09	10.1
47 (2)	X		3	24	19×0.12 (1)	0.62	0.21	120	0.10	0.88	-	2.30	12.7
48 (2)	X		3	22	19×0.16	0.85	0.38	55.4	0.10	1.08	-	2.73	18.9
49 (2)	X		3	20	19×0.20	1.04	0.60	34.9	0.12	1.28	-	3.25	28.0
50 (2)	X		3	18	19×0.25	1.29	0.93	22.2	0.15	1.53	-	3.86	42.0

NOTES: 1. Copper alloy.
2. With core identification as defined in Para. 4.4.3.2.

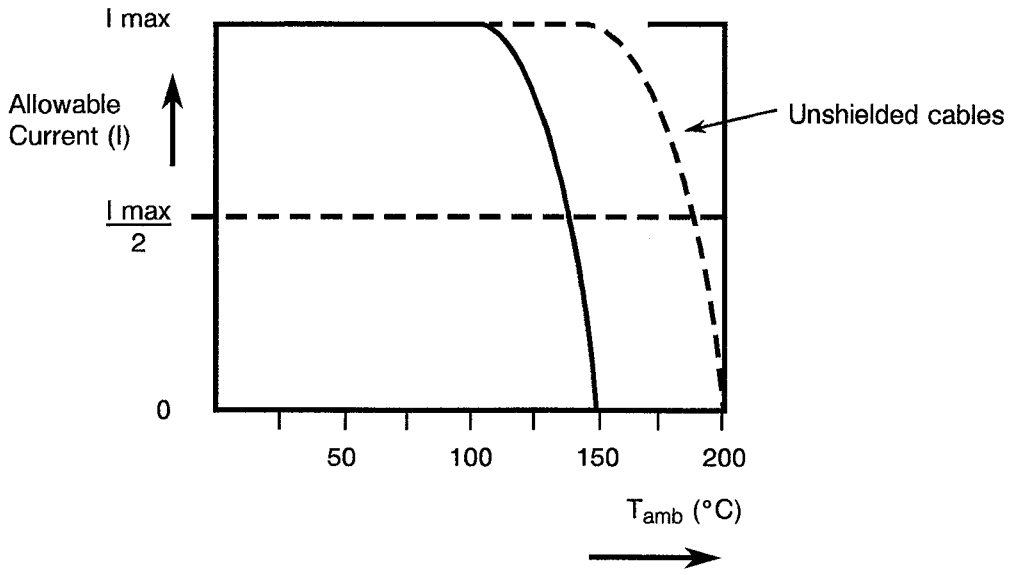
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Voltage	V_P	600	Vrms	
2	Maximum Current (Note 1)	I_{max}	2.5 3.5 5.0 7.5 10.0	A	For AWG 26 24 22 20 18
3	Operating Temperature Range	T_{amb}	−100 to +150	°C	−100 to +200 for unshielded cables
4	Storage Temperature Range	T_{stg}	−100 to +150	°C	−100 to +200 for unshielded cables

NOTES

1. The above specified current will generate a temperature rise of approximately 50°C above ambient temperature in a vacuum environment. Precautions shall be taken to prevent the total temperature of the wire (ambient plus rise) exceeding the continuous operating temperature of the wire.

FIGURE 1 - PARAMETER DERATING INFORMATION



Allowable Current versus Temperature

FIGURE 2 - PHYSICAL CHARACTERISTICS

Dimensions are given in Table 1(a)

FIGURE 2(a) - FINISHED WIRES

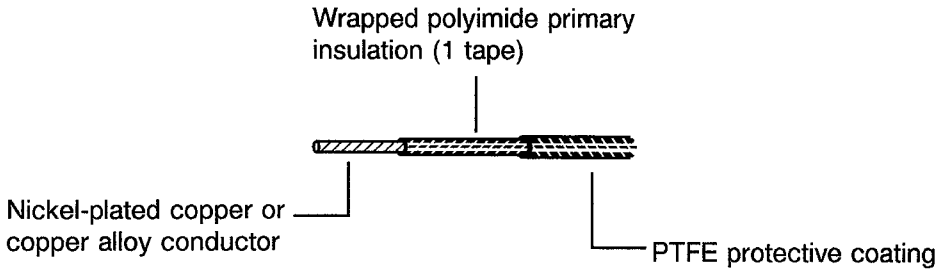


FIGURE 2(b) - SHIELDED AND JACKETED CABLES

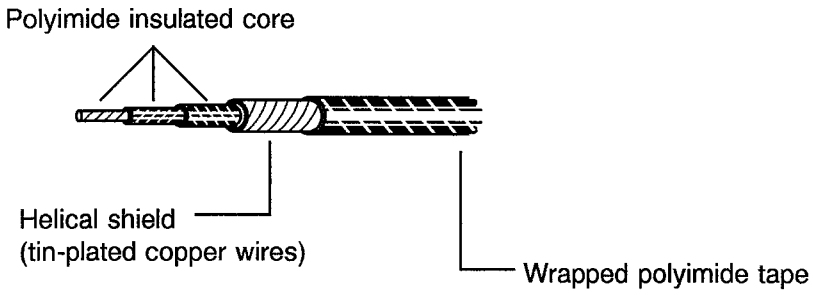
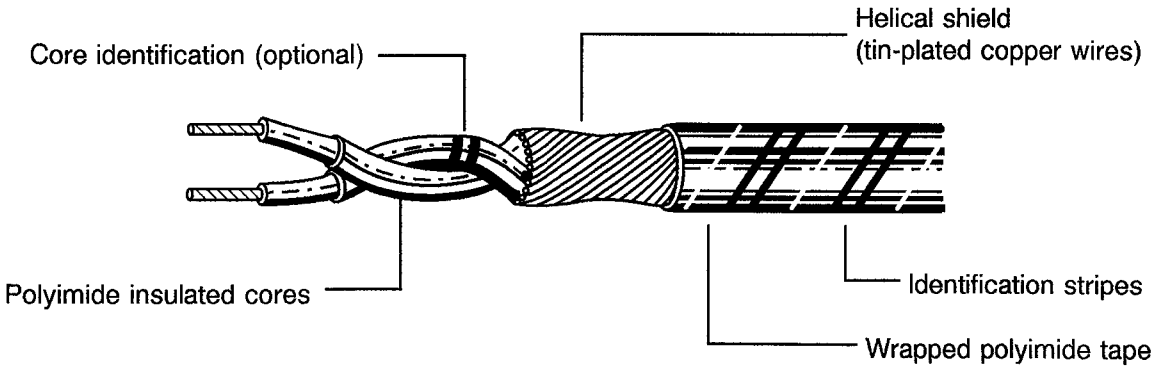


FIGURE 2(c) - SHIELDED AND JACKETED CABLES



2. APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

(a) ESA/SCC Generic Specification No. 3901, "Wires and Cables, Electrical, 600V, Low Frequency",

(b) MIL-W-81381, "Wires, Electric, Polyimide Insulated, Copper or Copper Alloy".

(c) MIL-F-14256, "Flux, Soldering, Liquid (Rosin Base)".

(d) ASTMB-355-74, "Nickel-coated Soft or Annealed Copper Wires".

(e) ASTMB-33-74, "Tinned Soft or Annealed Copper Wires for Electrical Purposes".

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESA/SCC Basic Specification No. 21300 and ESA/SCC Generic Specification No. 3901 shall apply.

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the finished wires and cables specified herein are stated in this specification and ESA/SCC Generic Specification No. 3901. Deviations from the Generic Specification, applicable to this specification only, are listed in Para 4.2.

Deviations from the applicable Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESA/SCC requirements and do not affect the components' reliability, are listed in the Appendices attached to this specification.

4.2 DEVIATIONS FROM GENERIC SPECIFICATION

4.2.1 Deviations from Special In-process Controls

None.

4.2.2 Deviations from Final Production Tests (Chart II)

(a) For shielded cables, the stripping capability shall be completed by a solderability test as defined in Para. 9.25 of the Generic Specification, using RMA-type flux according to MIL-F-14256.

4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III)

Not applicable.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Para. 9.21, "Resistance to Fluids": To be modified as stated in Para. 4.8.11 of this specification.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the finished wires and cables specified herein shall be checked; they shall conform to those shown in Table 1(a), Figure 2 and Para 4.4 of this specification (see below for the list of parameters to be checked).

LIST OF PARAMETERS TO BE CHECKED

PARAMETER	TABLE 1(a)	FIGURE 2	PARA 4.4
COMPOSITION			
Number of conductors	X		
Gauge	X		
Shielding	X		
Jacket		X	
CONDUCTOR			
Nature			X
Outer diameter	X		
Number of strands	X		
Strand diameter	X		
Length of lay			X
Nickel thickness			X
INSULATION			
Composition		X	X
Protective coating		X	X
Thickness			X
Overlapping			X
Outer diameter	X		
Core identification			X
SHIELDING			
Number of strands	X		
Type of shielding			X
Strand diameter	X		
Nature		X	X
Shield strand adhesion			X
Shielding lay			X
Shield coverage			X
JACKET			
Composition		X	X
Thickness			X
Overlapping			X
Outer diameter	X		
Stripe dimensions			X

4.3.2 Weight

The maximum weight of the finished wires and cables specified herein shall be as specified in Table 1(a).

4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the wires and cables specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

4.4.1 Conductor

4.4.1.1 Material Characteristics

All strands used in the manufacture of the conductors shall be nickel-coated, soft or annealed, oxygen-free high conductivity copper from AWG 18 to 22 inclusive and nickel-coated, high strength copper alloy from AWG 24 to 26.

On all copper conductors, any strand shall show a 10% minimum elongation. On all high-strength copper alloy conductors, any strand shall show a 6% minimum elongation at break and a 350N/mm^2 minimum tensile strength.

The resistance of the conductors shall be determined at +20°C in accordance with Para. 9.5 of ESA/SCC Generic Specification No. 3901, where the 'α' coefficient for copper alloy is 0.0035.

4.4.1.2 Stranding

The conductors shall be constructed of concentrically laid strands to produce a smooth and uniform conductor of circular cross-section and free from any high strands or other surface irregularities.

The length of the left-hand lay of the external layer shall not be less than 8, nor more than 16, times the maximum conductor diameter specified in Table 1(a).

4.4.1.3 Nickel Coating Characteristics

(a) Continuity

The nickel coating of strands shall be continuous. It shall not exhibit visible black spots after testing according to the ASTMB-355-74 method. The test shall be performed on 3 specimens.

(b) Adhesion

The nickel coating shall be firmly adherent to the surface of the copper. It shall not exhibit visible detachment after testing according to the ASTMB-355-74 method. The test shall be performed on 3 specimens.

(c) Nickel Thickness

The nickel coating on conductor strands shall be shown, by any convenient method, to be not less than 1.25 microns.

4.4.2 Insulation

4.4.2.1 Material

Any insulating material shall be virgin polyimide with only those additives that are necessary for processing and pigmentation.

4.4.2.2 Construction

The insulation shall consist of 1 wrapped ribbon of which the overlapping shall be equal to, or more than, 67%. The ribbon (30µm of thickness) shall conform to 0.1/1.0/0.1 type according to MIL-W-81381. The insulation shall have a uniform cross-section throughout the length of the cable and the conductor shall be evenly centred in the insulation. The nominal wall thickness, including the polyimide protective coating, shall be 0.11mm.

4.4.2.3 Insulation Colour

The insulation colour is prescribed in relation to the wire size as shown in the table of Para. 4.4.7.

4.4.3 Assembly

4.4.3.1 Construction

A multicore cable shall be constructed by assembling the cores in a right-hand concentric lay. The length of lay shall not be less than 10, nor more than 14, times the maximum multicore assembly diameter as detailed in Table 1(a).

4.4.3.2 Core Identification (Optional)

An optional core identification may be required for multicore cables. It consists of black-coloured rings painted on the cores according to the following parameters:

First core	: no ring.
Second core	: 2 rings.
Third core	: 3 rings.
Minimum ring width	: 0.7mm.
Minimum space between rings	: 1.0mm.
Space between groups of rings	: 15 to 20mm.

Small discontinuities of the ring are permitted.

Permanence of Core Identification

Core identification shall remain legible after 5 abrading actions performed on the painted rings with the aid of a pencil eraser.

4.4.4 Shield

4.4.4.1 Material

Shield strands shall be tin-coated, soft or annealed, high-conductivity copper. Any strand shall show a 10% minimum elongation (stretch at break).

4.4.4.2 Construction

The shield shall be closely, helically wound round the strands and provide not less than 92% coverage, 'K' being calculated by the following formula:-

$$K = \frac{n.d\sqrt{(L^2+P^2)}}{P.L}$$

where:-
K = % coverage,
n = total number of shield strands,

d = mean diameter of a shield strand,
L = apparent shielding lay,
P = outside perimeter of the shielded cable,

where:-
P = $\pi(D + d)$ - for a single core cable,
P = $\pi(D + d) + xD$ - for a multicore cable.

where:-
D = mean diameter of core insulation,
x = number of cores.

N.B.
The shield may exhibit an occasional gap between strands provided that:
- the coverage coefficient meets the required value.
- the gap width and gap length are no more than 0.5mm and 50mm respectively.

4.4.4.3 Tin-coating Characteristics

(a) Continuity

The tin-coating of shield strands shall be continuous. It shall not exhibit visible black spots after testing according to the ASTMB-33-74 method. The test shall be performed on 3 specimens taken before insulating.

(b) Adhesion

The tin-coating shall be firmly adherent to the surface of the copper. It shall not exhibit visible detachment after testing according to the ASTMB-33-74 method. The test shall be performed on 3 specimens taken before insulating.

(c) Tin Thickness

The tin-coating shall have a sufficient thickness to warrant a good solderability of the shield as defined in Para. 4.2.2 of this specification.

4.4.4.4 Shield Strand Adhesion

The shield shall meet the requirements of the shield strand adhesion test as defined hereafter.

- No more than 20% of the strands may be bonded.
- No more than 3 strands may be bonded together.

The specimen taken from the end of the manufacturing lot shall be a 10cm length of finished cable. With a stripping tool, remove the insulation from both ends of the sample such that 4.0cm and 2.0cm of shield are exposed. Hold the cores at the 2.0cm end and extract them. Examination of the shield shall be carried out at the 4.0cm end under ×10 magnification. During examination, the shield shall be opened out by performing a suitable rotating movement.

4.4.5 Jacket

For single-core and multicore shielded cables: 3 layers minimum of polyimide tape, type 0.1/1.0/0.1 according to MIL-W-81381, with identification by coloured stripes on the outside.

For multicore unshielded cables: 1 layer minimum of polyimide tape, type 0/1.0/0.5 according to MIL-W-81381, with coloured stripes on the outside.

4.4.6 Coloured Stripes

4.4.6.1 Colour Identification

Colour identification shall be as specified in Para. 4.4.7. Coloured stripes shall be helically applied on the jacket and grouped in a number equal to that of the cores.

4.4.6.2 Stripe Dimensions

Stripe width : 0.6mm.
Space between stripes : 1.0mm.
General tolerance : ±30%.

4.4.7 Colour Identification Code

The colour identification code for insulation, jacket and stripes shall be as specified in the following table.

COLOUR IDENTIFICATION CODE

Wire Size (AWG)	Insulation Colour	Jacket Colour		Colour of Stripes
		Twisted Cores	Shielded Cores	
26	Blue	Amber	Amber	Blue
24	White	Amber	Amber	White
22	Red	Amber	Amber	Red
20	Green	Amber	Amber	Green
18	Yellow	Amber	Amber	Yellow

4.5 MARKING

4.5.1 General

The marking of all spools of finished wires and cables delivered to this specification shall be in accordance with the requirements of ESA/SCC Basic Specification No. 21700. Each spool shall be marked in respect of:-

(a) The SCC Component Number.

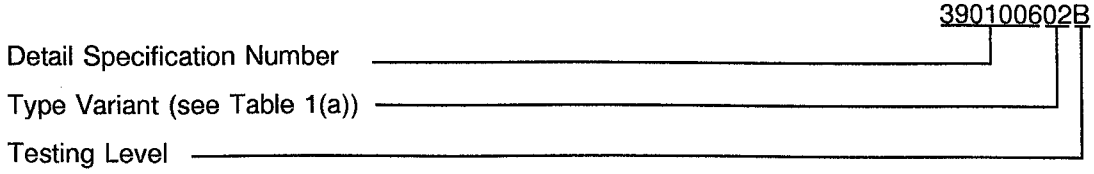
(b) Characteristics.

(c) Traceability Information.

(d) Additional Markings.

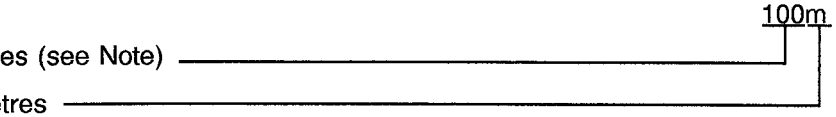
4.5.2 The SCC Component Number

Each spool shall bear the SCC Component Number which shall be constituted and marked as follows:-



4.5.3 Characteristics

The characteristics shall show the length(s) of finished wire or cable wound on each spool and shall be marked as follows:-



NOTE
Whenever the length is less than 100 metres, insert a zero in the first block (example: 075m). If more than one length of finished wire or cable is wound on a spool, the characteristics of each length shall be marked as above.

4.5.4 Traceability Information

Each spool shall be marked in respect of traceability information in accordance with the requirements of ESA/SCC Basic Specification No. 21700.

4.5.5 Additional Marking

Each spool shall bear the cable manufacturer's Quality Control Inspector's stamp or initials.

4.6 ELECTRICAL MEASUREMENTS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. The measurements shall be performed at $T_{amb} = +22 \pm 3$ °C.

4.6.2 Electrical Measurements at High and Low Temperatures

Not applicable.

4.6.3 Circuits for Electrical Measurements

Not applicable.

4.7 BURN-IN TESTS

Not applicable.

4.8 ENVIRONMENTAL AND ENDURANCE TESTS

4.8.1 Mechanical Properties of Conductor

As detailed in Para. 4.4.1.1 of this Specification.

4.8.2 Accelerated Ageing

Ageing Temperature +230 ± 5 °C.

The mandrel diameter and appropriate weight used for accelerated age testing of the finished wires is given in Table A.

NOTES

1. For shielded cables, a change in the shield's aspect shall not be cause for rejection.

TABLE A - MANDREL DIAMETERS AND LOADS FOR FINISHED WIRES

Wire Size (AWG)	Mandrel Diameter (mm)	Weight (kg)
26	6.0	0.25
24	6.0	0.25
22	6.0	0.4
20	6.0	0.4
18	10	0.5

4.8.3 Wrap Test at Ambient Temperature

The mandrel diameters and applied loads for wrap testing of finished wires are given in Table A. The mandrel diameters and applied loads for screened and jacketed cables are given in Table B.

TABLE B - MANDREL DIAMETERS AND LOADS FOR SHIELDED AND JACKETED CABLES

Cable Size (AWG)	Number of Cores	Mandrel Diameter (mm)	Load (kg)
26	1	6.0	0.25
24	1	6.0	0.25
22	1	6.0	0.4
20	1	6.0	0.4
18	1	10	0.5
26	2	6.0	0.5
24	2	12	0.5
22	2	12	0.8
20	2	12	0.8
18	2	12	1.0
26	3	12	0.75
24	3	12	0.75
22	3	12	1.2
20	3	12	1.2
18	3	12	1.5

4.8.4 Voltage Test

No particular conditions are applicable.

4.8.5 Shrinkage

The shrinkage temperature shall be $+230 \pm 5$ °C

4.8.6 Blocking

The blocking temperature shall be $+200 \pm 5$ °C.

4.8.7 Cold Bend Test

The mandrel diameters and loads shall be as specified in Table C.

TABLE C - MANDREL DIAMETERS AND LOADS FOR FINISHED WIRES OR CORES

Wire Size (AWG)	Mandrel Diameter (mm)	Weight (kg)
26	6.0	0.25
24	6.0	0.25
22	6.0	0.4
20	6.0	0.4
18	10	0.5

4.8.8 Cut-through Resistance

The mean load measured during the required tests shall not be less than the relevant value specified below:-

Wire Size (AWG)	26	24	22	20	18
Cut-through Load (kg)	9	11	15	19	25

4.8.9 Notch Resistance

The depth of notch shall be 0.04mm.

4.8.10 Flammability

No particular conditions are applicable.

4.8.11 Resistance to Fluids

Tests (e) and (f) shall not be performed.

4.8.12 Surface Resistance

No particular conditions are applicable.

4.8.13 Abrasion Resistance

The weight to be applied to the needle is specified below:-

Wire Size (AWG)	26	24	22	20	18
Scrape Abrasion Load (g)	450	500	600	650	750

4.8.14 Soldering

Not applicable.

4.8.15 Solderability (Applicable to the shield only)

RMA type flux according to MIL-F-14256 shall be used.

4.8.16 Radiation Resistance

No particular conditions are applicable.

4.8.17 Overload Resistance

No particular conditions are applicable.

4.8.18 Long-term Ageing Test

The long-term ageing temperature shall be +150°C. For shielded cables, a change in the shield's aspect shall not be cause for rejection.

4.8.19 Anthony and Brown Test

Not applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	CHARACTERISTICS	SPEC. AND/OR TEST METHOD	TEST CONDITION	LIMITS	UNIT
1	Conductor Resistance	ESA/SCC No. 3901, Section 9	Para 9.5	Table 1(a)	Ω/km
2	Spark Test	ESA/SCC No. 3901, Section 9	Para 9.6	Insulation : 3 Jacket : 1.5	kV
3	Voltage Test	ESA/SCC No. 3901, Section 9	Para 9.7	Para 9.7	kV
4	Insulation Resistance	ESA/SCC No. 3901, Section 9	Para 9.8	Insulation : 750 Jacket : 30	MΩ.km
5	Surface Resistance	ESA/SCC No. 3901, Section 9	Para 9.22	: 125	MΩ.mm