



**POLYIMIDE INSULATED FINISHED WIRES AND CABLES,
LOW FREQUENCY, 600V, -100 TO +200°C**

ESCC Detail Specification No. 3901/001

Issue 3	March 2024
---------	------------



LEGAL DISCLAIMER AND COPYRIGHT

European Space Agency, Copyright © 2024. All rights reserved.

The European Space Agency disclaims any liability or responsibility, to any person or entity, with respect to any loss or damage caused, or alleged to be caused, directly or indirectly by the use and application of this ESCC publication.

This publication, without the prior permission of the European Space Agency and provided that it is not used for a commercial purpose, may be:

- copied in whole, in any medium, without alteration or modification.
- copied in part, in any medium, provided that the ESCC document identification, comprising the ESCC symbol, document number and document issue, is removed.

DOCUMENTATION CHANGE NOTICE

(Refer to <https://escies.org> for ESCC DCR content)

DCR No.	CHANGE DESCRIPTION
1616	Specification upissued to incorporate changes per DCR.

TABLE OF CONTENTS

1	GENERAL	6
1.1	SCOPE	6
1.2	COMPONENT TYPE VARIANTS	6
1.3	MAXIMUM RATINGS	6
1.4	PARAMETER DERATING INFORMATION	6
1.5	PHYSICAL CHARACTERISTICS	6
1.6	FUNCTIONAL DIAGRAM	6
2	APPLICABLE DOCUMENTS	10
3	TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS	10
4	REQUIREMENTS	10
4.1	GENERAL	10
4.2	DEVIATIONS FROM GENERIC SPECIFICATION	10
4.2.1	Deviations from Special In-process Controls	10
4.2.2	Deviations from Final Production Tests - Chart II	10
4.2.3	Deviations from Burn-in and Electrical Measurements - Chart III	10
4.2.4	Deviations from Qualification Tests - Chart IV	10
4.2.5	Deviations from Lot Acceptance Tests - Chart V	10
4.3	MECHANICAL REQUIREMENTS	11
4.3.1	Dimension Check	11
4.3.2	Weight	11
4.4	MATERIALS AND FINISHES	12
4.4.1	Conductor	12
4.4.2	Finished Wire/Core Insulation	12
4.4.3	Cable Assembly	12
4.4.4	Shield	13
4.4.5	Jacket	13
4.4.6	Colour Codes	14
4.5	MARKING	14
4.5.1	General	14
4.5.2	The ESCC Component Number	15
4.5.3	Traceability Information	16
4.5.4	Additional Marking	16
4.6	ELECTRICAL MEASUREMENTS	16
4.6.1	Electrical Measurements at Room Temperature	16
4.6.2	Electrical Measurements at High and Low Temperatures	16
4.6.3	Circuits for Electrical Measurements (Figure 4)	16

4.7	BURN-IN TESTS	16
4.8	ENVIRONMENTAL AND ENDURANCE TESTS	16
4.8.1	Mechanical Properties of Conductor	16
4.8.2	Accelerated Ageing	16
4.8.3	Wrap Test at Ambient Temperature	17
4.8.4	Voltage Test	17
4.8.5	Shrinkage	17
4.8.6	Blocking	17
4.8.7	Cold Bend Test	17
4.8.8	Cut-through Resistance	17
4.8.9	Notch Resistance	18
4.8.10	Flammability	18
4.8.11	Resistance to Fluids	18
4.8.12	Surface Resistance	18
4.8.13	Abrasion Resistance	18
4.8.14	Soldering	18
4.8.15	Solderability (applicable to the shield only)	18
4.8.16	Radiation Resistance	18
4.8.17	Overload Resistance	18
4.8.18	Long-term Ageing Test	18
4.8.19	Anthony & Brown Test	18

1 GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Polyimide Insulated, Finished Wires and Cables, Low Frequency, 600V, -100°C to +200°C. It shall be read in conjunction with ESCC Generic Specification No. 3901, the requirements of which are supplemented herein.

NOTES:

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

1.2 COMPONENT TYPE VARIANTS

Variants of the basic types of finished 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 core used in a cable 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 cores in the cable.

- The temperature derating information is shown in Figure 1 with maximum current I_{max} for a single wire/core.
- 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) – COMPONENT TYPE VARIANTS

Variant No.	Shielded	Un-shielded	No. of Cores	Wire Size AWG	Stranding No of Strands × Diameter (mm)	Conductor Characteristics			Shield Strand Ø (mm)	Core Max Ø (mm)	Finished Wire/Cable	
						Max Ø (mm)	Nom Sect. (mm ²)	Max Ohmic Resistance (Ω/km)			Characteristics	
											Max Ø (mm)	Max Weight (kg/km)
Variants 01 through 23 deleted, not to be used												
24		X	1	26	19×0.1 (1)	0.53	0.15	148	-	-	0.84	2.05
25		X	1	24	19×0.12 (1)	0.64	0.21	105	-	-	0.95	2.75
26		X	1	22	19×0.16	0.85	0.38	50.9	-	-	1.15	4.4
27		X	1	20	19×0.2	1.04	0.6	32.2	-	-	1.35	6.65
28		X	1	18	19×0.25	1.29	0.93	20.6	-	-	1.6	9.98
29		X	1	16	19×0.3	1.53	1.3	14.3	-	-	1.85	14
30		X	1	14	27×0.3	1.87	1.9	10.1	-	-	2.19	19.6
31		X	1	12	45×0.3	2.5	3.2	6.03	-	-	2.8	32.1
32		X	2	16	19×0.3	1.53	1.3	15	-	1.85	3.8	30.7
33		X	2	14	27×0.3	1.87	1.9	10.6	-	2.19	4.48	43.1
34		X	2	12	45×0.3	2.4	3.2	6.33	-	2.8	5.7	70.6
35		X	3	16	19×0.3	1.53	1.3	15	-	1.85	4.08	46.1
36		X	3	14	27×0.3	1.87	1.9	10.6	-	2.19	4.82	64.6
37		X	3	12	45×0.3	2.4	3.2	6.33	-	2.8	6.15	106
38	X		1	16	19×0.3	1.53	1.3	14.3	0.1	1.85	2.23	18.8
39	X		1	14	27×0.3	1.87	1.9	10.1	0.12	2.19	2.63	27
40	X		1	12	45×0.3	2.4	3.2	6.03	0.15	2.8	3.3	43.3
41	X		2	16	19×0.3	1.53	1.3	15	0.15	1.85	4.26	41.8
42	X		2	14	27×0.3	1.87	1.9	10.6	0.15	2.19	5.07	55.6
43	X		2	12	45×0.3	2.4	3.2	6.33	0.2	2.8	6.3	90.5
44	X		3	16	19×0.3	1.53	1.3	15	0.15	1.85	4.54	58.2
45	X		3	14	27×0.3	1.87	1.9	10.6	0.2	2.19	5.4	83.3
46	X		3	12	45×0.3	2.4	3.2	6.33	0.2	2.8	6.72	127.3
47		X	1	28	19×0.08 (1)	0.43	0.1	242	-	-	0.73	1.37

NOTES:

1. Copper alloy.

TABLE 1(b) – MAXIMUM RATINGS

No.	Characteristics	Symbol	Maximum Rating	Unit	Remarks
1	Voltage	V_P	600	Vrms	
2	Maximum Current (each finished wire/core) (Note 1)	I_{max}	1.5 2.5 3.5 5 7.5 10 13 17 23	A	For AWG: 28 26 24 22 20 18 16 14 12
3	Operating Temperature Range	T_{amb}	-100 to +200	°C	
4	Storage Temperature Range	T_{stg}	-100 to +200	°C	

NOTES:

- 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

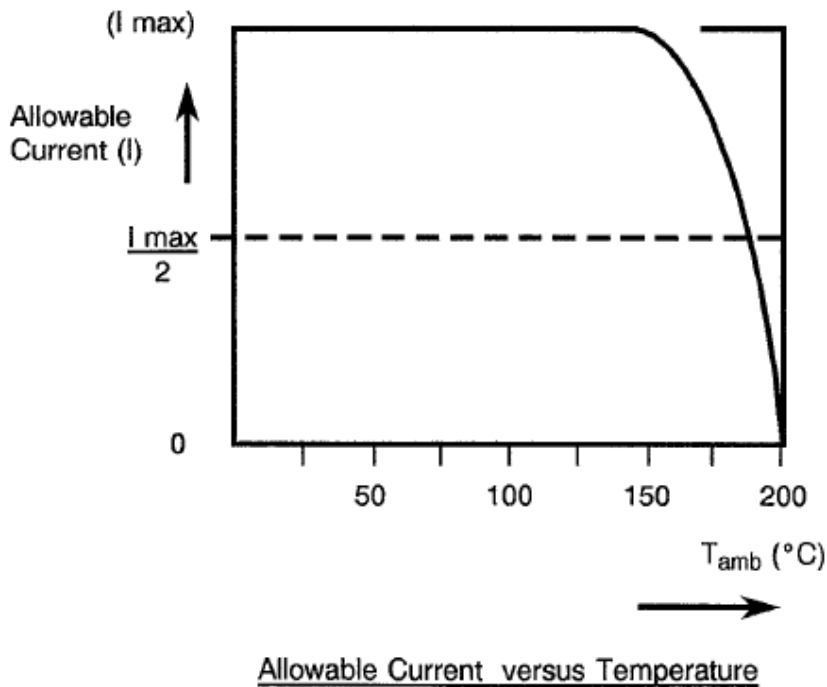


FIGURE 2 – PHYSICAL CHARACTERISTICS

Dimensions are given in Table 1(a)

FIGURE 2(a) – FINISHED WIRE / CORE

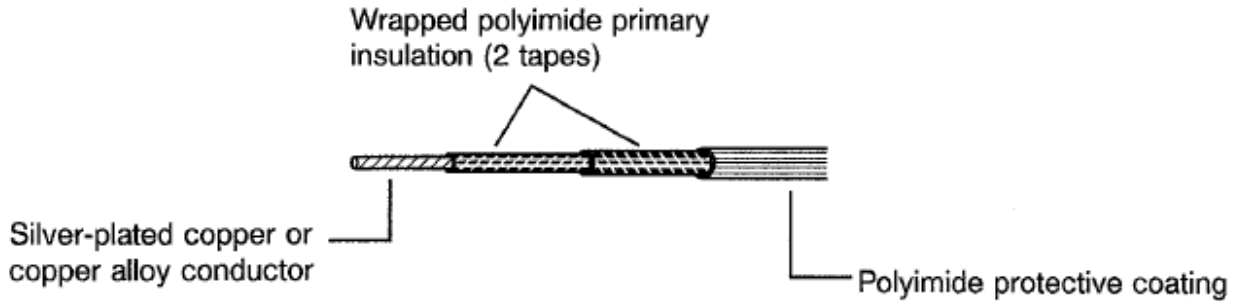


FIGURE 2(b) – SHIELDED AND JACKETED CABLES

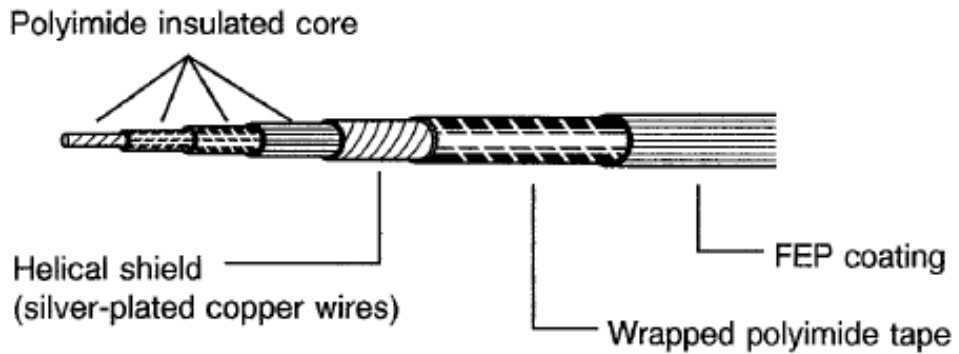
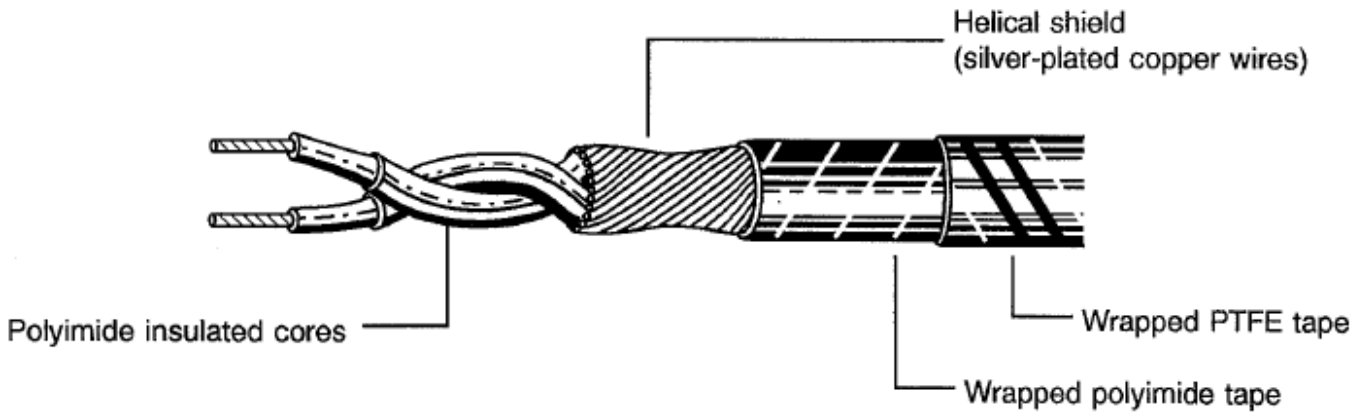


FIGURE 2(c) – SHIELDED AND JACKETED CABLES



2 **APPLICABLE DOCUMENTS**

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

- (a) ESCC Generic Specification No. [3901](#), Wires and Cables, Electrical, 600V, Low Frequency.
- (b) MIL-DTL-81381, Wire, Electric, Polyimide-Insulated, Copper or Copper Alloy.

3 **TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS**

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. [21300](#) and ESCC Generic Specification No. [3901](#) shall apply.

4 **REQUIREMENTS**

4.1 **GENERAL**

The complete requirements for procurement of the finished wires/cables specified herein are stated in this specification and ESCC 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 ESCC 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**

None.

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/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
<u>COMPOSITION</u>			
Number of conductors	X		
Gauge	X		
Shielding	X		
Jacket		X	
<u>CONDUCTOR</u>			
Nature			X
Outer diameter	X		
Number of strands	X		
Strand diameter	X		
Length of lay			X
Silver thickness			X
<u>INSULATION</u>			
Composition and Colour		X	X
Protective coating		X	X
Thickness			X
Overlapping			X
Outer diameter	X		
<u>SHIELDING</u>			
Number of strands	X		
Type of shielding			X
Strand diameter	X		
Nature		X	X
Silver thickness			X
Shielding lay			X
Shield coverage			X
<u>JACKET</u>			
Composition and Colour		X	X
Protective coating		X	X
Thickness			X
Overlapping			X
Outer diameter	X		
Stripe dimensions			X

4.3.2 Weight

The maximum weight of the finished wires/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 finished wires/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 silver-coated, soft or annealed, oxygen-free high conductivity copper from AWG 12 to 22 inclusive and silver-coated, high strength copper alloy from AWG 24 to 28. On silver-coated strands, the thickness of the silver shall be 2 microns minimum.

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/mm² minimum tensile strength.

The resistance of the conductors shall be determined at +20°C in accordance with Para. 9.5 of ESCC 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).

4.4.2 Finished Wire/Core 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 2 ribbons wrapped in a reverse way, the overlapping of which shall be equal to, or more than, 51%. Each ribbon (30µm of thickness) shall conform to 0.1/1.0/0.1 type according to MIL-DTL-81381. The insulation shall have a uniform cross-section throughout the length of the finished wire/core and the conductor shall be evenly centred in the insulation. The nominal wall thickness, including the polyimide protective coating, shall be 0.14mm.

4.4.2.3 *Insulation Colour*

See Paras. 4.4.6.

4.4.3 Cable Assembly

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).

4.4.4 Shield

4.4.4.1 *Material*

Shield strands shall meet the requirements for silver-coated annealed copper as outlined in Para. 4.4.1.1 of this specification.

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

where:

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

where:

- D = mean diameter of core insulation
- x = the number of cores

NOTE: 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

4.4.5 Jacket

For single-core shielded cables: 2 layers minimum of polyimide tape, type 0.1/1.0/0.1 according to MIL-DTL-81381, coated with pigmented FEP before identification by coloured stripes on the outside.

For multicore shielded cables: 1 layer minimum of polyimide tape, type 0.1/1.0/0.1 according to MIL-DTL-81381, plus 1 layer of coloured PTFE tape with coloured stripes on the outside.

For multicore unshielded cables: 1 layer minimum of polyimide tape, type 0.1/1.0/0.1 according to MIL-DTL-81381, with coloured stripes on the outside.

4.4.5.1 *Jacket Colour*

Jacket colour: see Para. 4.4.6.

Coloured stripes shall be helically applied on the jacket and grouped in a number equal to that of the quantity of cores. Jacket stripe colour shall be as specified in Para. 4.4.6.

Jacket stripe dimensions shall be as follows:

- Stripe width: 0.6mm.
- Space between stripes: 1mm.
- General tolerance: $\pm 30\%$.

4.4.6 Colour Codes

- (a) Without Finished Wire/Core Colour Identification (see Para. 4.5.2(a)):
When the ESCC Component Number, as stipulated in the Purchase Order, does not include a finished wire/core colour identification, the default colour codes for the cable jacket and the jacket stripes as well as all finished wire/cable core(s) insulation shall be as follows:

DEFAULT COLOUR CODING

Wire Size (AWG)	All Finished Wire/Cable Core(s) Insulation Colour	Cable Jacket Colour		Cable Jacket Stripes Colour
		Polyimide / Unshielded	PTFE or FEP Coating / Shielded	
28	Brown	Amber	White	Brown
26	Black	Amber	White	Black
24	Khaki-Beige	Amber	Light blue	White
22	Red	Amber	White	Red
20	Green	Amber	White	Green
18	Yellow	Amber	White	Yellow
16	Brown	Amber	White	Brown
14	Khaki-Beige	Amber	Light blue	White
12	Khaki-Beige	Amber	Light blue	White

- (b) With Finished Wire/Core Colour Identification (see Para. 4.5.2(b)):
When the ESCC Component Number, as stipulated in the Purchase Order, includes a finished wire/core colour identification, the custom colour(s) of the finished wire/cable core(s) insulation shall be as specified by the Orderer in any combination selected from the following 6 available (see Para. 4.5.2.2(b)):

- **Black, Brown, Red, Yellow, Green, Khaki-Beige**

The colour codes for the cable jacket and the jacket stripes shall be as specified in (a) above.

4.5 MARKING

4.5.1 General

The marking of all spools of finished wires/cables delivered to this specification shall be in accordance with the requirements of ESCC Basic Specification No. 21700.

Each spool shall be marked in respect of:

- The ESCC qualified components symbol (for ESCC qualified components only).
- The ESCC Component Number (see Note 1)
- Traceability Information.
- Additional Marking.

NOTES:

- Whenever more than one length of finished wire/cable is wound on a single spool, the full marking for each length including the ESCC Component Numbers shall be marked on the spool. The characteristic code(s) for each length (see Para. 4.5.2.2(a)) may be marked separately on the spool.

4.5.2 The ESCC Component Number

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

- (a) Without finished wire/core colour identification (see Para. 4.4.6(a)):

Example: 390100144B100m

- Detail Specification Reference: 3901001
- Component Type Variant Number (see Table 1(a)): 44 (as required)
- Testing level (B is mandatory): B
- Characteristic code: finished wire/cable length: 100m (as required; see Para. 4.5.2.2(a))

- (b) With finished wire/core colour identification (see Para. 4.4.6(b)):

Example: 390100144B100m024

- Detail Specification Reference: 3901001
- Component Type Variant Number (see Table 1(a)): 44 (as required)
- Testing level (B is mandatory): B
- Characteristic code: finished wire/cable length: 100m (as required; see Para. 4.5.2.2(a))
- Characteristic code: finished wire/core colour identification (**black**, **red**, **yellow**): 024 (as required; see Para. 4.5.2.2(b))

4.5.2.2 Characteristics Codes

Characteristics to be codified as part of the ESCC Component Number shall be as follows:

- (a) Finished Wire/Cable Length:

The required length of the finished wire/cable expressed by means of the following codes. The unit quantity shall be metre (m).

Nominal Length (m)	Code
X	00Xm
XX	0XXm
XXX	XXXm

- (b) Finished Wire/Core Colour Identification:

When included as part of the ESCC Component Number, the required custom colour(s) of the finished wire/core(s) insulation expressed by means of up to 3 single digits as follows:

No. of Cores	Code	Remarks
1	X	See Note 1. Also applies to finished wires
2	XX	See Note 1
3	XXX	See Note 1

NOTES:

1. The individual digits to be used for the 6 available colours are as follows:

- **Black:** 0
- **Brown:** 1
- **Red:** 2
- **Yellow:** 4
- **Green:** 5
- **Khaki-Beige:** 9

4.5.3 Traceability Information

Each spool shall be marked in respect of traceability information in accordance with the requirements of ESCC Basic Specification No. [21700](#).

4.5.4 Additional Marking

Each spool shall bear the finished wire/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 $T_{amb} = +22 \pm 3^{\circ}\text{C}$.

4.6.2 Electrical Measurements at High and Low Temperatures

Not applicable.

4.6.3 Circuits for Electrical Measurements (Figure 4)

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: $+230 \pm 5^{\circ}\text{C}$.

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

TABLE A – MANDREL DIAMETERS AND LOADS FOR FINISHED WIRES

Wire Size (AWG)	Mandrel Diameter (mm)	Weight (kg)
28	6	0.125
26	6	0.25
24	6	0.25
22	6	0.4
20	6	0.4
18	10	0.5
16	10	0.5
14	15	1
12	20	1

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 cables are given in Table B.

TABLE B – MANDREL DIAMETERS AND LOADS FOR CABLES

Cable Size (AWG)	Number of Cores	Mandrel Diameter (mm)	Load (kg)
16	1	15	0.5
14	1	15	1
12	1	15	1
16	2	15	1
14	2	20	2
12	2	20	2
16	3	20	1.5
14	3	20	3
12	3	25	3

4.8.4 Voltage Test

No particular conditions are applicable.

4.8.5 Shrinkage

The shrinkage temperature shall be $+230 \pm 5^{\circ}\text{C}$.

4.8.6 Blocking

The blocking temperature shall be $+200 \pm 5^{\circ}\text{C}$.

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/CABLE CORES

Wire Size (AWG)	Mandrel Diameter (mm)	Weight (kg)
28	6	0.125
26	6	0.25
24	6	0.25
22	6	0.4
20	6	0.4
18	10	0.5
16	10	0.5
14	15	1
12	20	1

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)	28	26	24	22	20	18	16	14	12
Cut-through Load (kg)	12	15	17	21	26	34	43	54	66

4.8.9 Notch Resistance
The depth of notch shall be 0.06mm.

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)	28	26	24	22	20	18	16	14	12
Scrape Abrasion Load (g)	500	650	750	800	900	950	1050	1100	1200

4.8.14 Soldering
No particular conditions are applicable.

4.8.15 Solderability (applicable to the shield only)
No particular conditions are applicable.

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 +200°C.

4.8.19 Anthony & Brown Test
No particular conditions are applicable.

TABLE 2 – ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	Characteristics	Spec. and/or Test Method	Test Condition	Limits	Unit
1	Conductor Resistance	ESCC No. 3901, Section 9	Para. 9.5	Table 1(a)	Ω/km
2	Spark Test	ESCC No. 3901, Section 9	Para. 9.6 Insulation: 3kV Jacket: 1.5kV	Para. 9.6	-
3	Voltage Test	ESCC No. 3901, Section 9	Para. 9.7	Para. 9.7	-
4	Insulation Resistance	ESCC No. 3901, Section 9	Para. 9.8	Insulation: ≥ 750 Jacket: ≥ 30	MΩ.km MΩ.km
5	Surface Resistance	ESCC No. 3901, Section 9	Para. 9.22	> 125	MΩ.mm