# POLYIMIDE INSULATED SHIELDED CABLES WITH DRAIN WIRE, LOW FREQUENCY, 600V, -200 TO +200°C

## BASED ON TYPE SPLD

## ESCC Detail Specification No. 3901/021

| | |
|---|---|
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## DOCUMENTATION CHANGE NOTICE

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| DCR No. | CHANGE DESCRIPTION |
|---|---|
| 1662 | Specification upissued to incorporate changes per DCR. |

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# 1 GENERAL

## 1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for Polyimide Insulated Shielded Cables with Drain Wire, Low Frequency, 600V, -200 to +200°C, Based on Type SPLD.

It shall be read in conjunction with ESCC Generic Specification No. 3901, the requirements of which are supplemented herein.

**NOTES:**

1. These 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 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 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 cables specified herein is as follows:

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

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

  $I_{Bmax}=\frac{I_{max}}{2}$ (for $n \geq 15$)

  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 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 cables specified herein are shown in Figure 2 and Table 1(a).

## 1.6 FUNCTIONAL DIAGRAM

Not applicable.

**TABLE 1(a) – COMPONENT TYPE VARIANTS**

| Variant No. | Drain Wire Size ISO / (AWG) | Drain Wire No. of Strands × Diameter (mm) | No. of Cores | Wire (Core) Size ISO / (AWG) | Stranding No. of Strands × Diameter (mm) | Conductor Characteristics | | | Shield Strand Ø (mm) | Core Max Ø (mm) | Cable Characteristics | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Max Ø (mm) | Nom Section ($mm^2$) | Max Ohmic Resistance (Ω/km) | | | Max Ø (mm) | Max Weight (kg/km) |
| 01 | - /(30) | 07×0.102 | 1 | - /(30) | 07×0.102 | 0.32 | 0.057 | 375 | 0.063 | 0.78 | 1.4 | 3.4 |
| 02 | - /(28) | 07×0.127 | 1 | - /(28) | 07×0.127 | 0.39 | 0.09 | 253 | 0.079 | 0.87 | 1.6 | 4.8 |
| 03 | 001/(26) | 19×0.1(1) | 1 | 001/(26) | 19×0.1(1) | 0.47 | 0.15 | 157 | 0.079 | 0.99 | 1.8 | 5.8 |
| 04 | 002/(24) | 19×0.12(1) | 1 | 002/(24) | 19×0.12(1) | 0.58 | 0.25 | 111 | 0.079 | 1.13 | 2.1 | 7.4 |
| 05 | 004/(22) | 19×0.15(1) | 1 | 004/(22) | 19×0.15(1) | 0.76 | 0.4 | 58 | 0.079 | 1.26 | 2.4 | 12 |
| 06 | 006/(20) | 19×0.2(1) | 1 | 006/(20) | 19×0.2(1) | 0.99 | 0.6 | 32 | 0.079 | 1.48 | 2.9 | 17 |
| 07 | - /(18) | 19×0.25 | 1 | - /(18) | 19×0.25 | 1.29 | 0.96 | 21 | 0.079 | 1.7 | 3.9 | 30 |
| 08 | 012/(16) | 19×0.3(1) | 1 | 012/(16) | 19×0.3(1) | 1.49 | 1.2 | 14 | 0.079 | 1.98 | 4 | 34 |
| 09 | 030/(12) | 37×0.32(1) | 1 | 030/(12) | 37×0.32(1) | 2.18 | 3 | 7 | 0.079 | 2.7 | 5.3 | 66 |
| 10 | - /(30) | 07×0.102 | 2 | - /(30) | 07×0.102 | 0.32 | 0.057 | 383 | 0.063 | 0.78 | 2.2 | 5.7 |
| 11 | - /(28) | 07×0.127 | 2 | - /(28) | 07×0.127 | 0.39 | 0.09 | 258 | 0.079 | 0.87 | 2.5 | 7 |
| 12 | 001/(26) | 19×0.1(1) | 2 | 001/(26) | 19×0.1(1) | 0.47 | 0.15 | 170 | 0.079 | 0.99 | 2.8 | 9.1 |
| 13 | 002/(24) | 19×0.12(1) | 2 | 002/(24) | 19×0.12(1) | 0.58 | 0.25 | 120 | 0.079 | 1.13 | 3.3 | 11.4 |
| 14 | 004/(22) | 19×0.15(1) | 2 | 004/(22) | 19×0.15(1) | 0.76 | 0.4 | 63 | 0.079 | 1.26 | 3.7 | 17 |
| 15 | 006/(20) | 19×0.2(1) | 2 | 006/(20) | 19×0.2(1) | 0.99 | 0.6 | 35 | 0.079 | 1.48 | 4.3 | 25 |
| 16 | 012/(16) | 19×0.3(1) | 2 | 012/(16) | 19×0.3(1) | 1.49 | 1.2 | 15 | 0.079 | 1.98 | 5.9 | 48 |
| 17 | 030/(12) | 37×0.32(1) | 2 | 030/(12) | 37×0.32(1) | 2.18 | 3 | 7.5 | 0.079 | 2.73 | 8 | 95 |
| 18 | - /(30) | 07×0.102 | 3 | - /(30) | 07×0.102 | 0.32 | 0.057 | 385 | 0.063 | 0.78 | 2.3 | 6.7 |
| 19 | - /(28) | 07×0.127 | 3 | - /(28) | 07×0.127 | 0.39 | 0.09 | 259 | 0.079 | 0.87 | 2.7 | 9.2 |
| 20 | 001/(26) | 19×0.1(1) | 3 | 001/(26) | 19×0.1(1) | 0.47 | 0.15 | 171 | 0.079 | 0.99 | 2.9 | 12 |
| 21 | 002/(24) | 19×0.12(1) | 3 | 002/(24) | 19×0.12(1) | 0.58 | 0.25 | 121 | 0.079 | 1.13 | 3.4 | 15 |
| 22 | 004/(22) | 19×0.15(1) | 3 | 004/(22) | 19×0.15(1) | 0.76 | 0.4 | 64 | 0.079 | 1.26 | 3.9 | 21 |
| 23 | 006/(20) | 19×0.2(1) | 3 | 006/(20) | 19×0.2(1) | 0.99 | 0.6 | 37 | 0.079 | 1.48 | 4.6 | 33 |
| 24 | - /(30) | 07×0.102 | 4 | - /(30) | 07×0.102 | 0.32 | 0.057 | 386 | 0.063 | 0.78 | 2.5 | 8.2 |

| Variant No. | Drain Wire Size ISO / (AWG) | Drain Wire No. of Strands × Diameter (mm) | No. of Cores | Wire (Core) Size ISO / (AWG) | Stranding No. of Strands × Diameter (mm) | Conductor Characteristics | | | Shield Strand Ø (mm) | Core Max Ø (mm) | Cable Characteristics | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Max Ø (mm) | Nom Section ($mm^2$) | Max Ohmic Resistance (Ω/km) | | | Max Ø (mm) | Max Weight (kg/km) |
| 25 | - /(28) | 07×0.127 | 4 | - /(28) | 07×0.127 | 0.39 | 0.09 | 260 | 0.079 | 0.87 | 2.9 | 11 |
| 26 | 001/(26) | 19×0.1(1) | 4 | 001/(26) | 19×0.1(1) | 0.47 | 0.15 | 171 | 0.079 | 0.99 | 3.2 | 14 |
| 27 | 002/(24) | 19×0.12(1) | 4 | 002/(24) | 19×0.12(1) | 0.58 | 0.25 | 122 | 0.079 | 1.13 | 3.7 | 18 |
| 28 | 004/(22) | 19×0.15(1) | 4 | 004/(22) | 19×0.15(1) | 0.76 | 0.4 | 64 | 0.079 | 1.26 | 4.2 | 26 |
| 29 | 006/(20) | 19×0.2(1) | 4 | 006/(20) | 19×0.2(1) | 0.99 | 0.6 | 37 | 0.079 | 1.48 | 4.9 | 40 |
| 30 | 001/(26) | 19×0.1(1) | 5 | 001/(26) | 19×0.1(1) | 0.47 | 0.15 | 172 | 0.079 | 0.99 | 3.4 | 17 |
| 31 | 002/(24) | 19×0.12(1) | 5 | 002/(24) | 19×0.12(1) | 0.58 | 0.25 | 123 | 0.079 | 1.13 | 4 | 22 |
| 32 | 004/(22) | 19×0.15(1) | 5 | 004/(22) | 19×0.15(1) | 0.76 | 0.4 | 64 | 0.079 | 1.26 | 4.5 | 32 |
| 33 | 006/(20) | 19×0.2(1) | 5 | 006/(20) | 19×0.2(1) | 0.99 | 0.6 | 37 | 0.079 | 1.48 | 5.4 | 49 |
| 34 | 001/(26) | 19×0.1(1) | 6 | 001/(26) | 19×0.1(1) | 0.47 | 0.15 | 172 | 0.079 | 0.99 | 3.7 | 20 |
| 35 | 002/(24) | 19×0.12(1) | 6 | 002/(24) | 19×0.12(1) | 0.58 | 0.25 | 124 | 0.079 | 1.13 | 4.4 | 26 |
| 36 | 004/(22) | 19×0.15(1) | 6 | 004/(22) | 19×0.15(1) | 0.76 | 0.4 | 65 | 0.079 | 1.26 | 4.9 | 37 |
| 37 | 006/(20) | 19×0.2(1) | 6 | 006/(20) | 19×0.2(1) | 0.99 | 0.6 | 38 | 0.079 | 1.48 | 5.8 | 62 |
| 38 | 001/(26) | 19×0.1(1) | 7 | 001/(26) | 19×0.1(1) | 0.47 | 0.15 | 172 | 0.079 | 0.99 | 3.7 | 22 |
| 39 | 002/(24) | 19×0.12(1) | 7 | 002/(24) | 19×0.12(1) | 0.58 | 0.25 | 124 | 0.079 | 1.13 | 4.4 | 28 |
| 40 | 004/(22) | 19×0.15(1) | 7 | 004/(22) | 19×0.15(1) | 0.76 | 0.4 | 65 | 0.079 | 1.26 | 4.9 | 40 |
| 41 | 006/(20) | 19×0.2(1) | 7 | 006/(20) | 19×0.2(1) | 0.99 | 0.6 | 38 | 0.079 | 1.48 | 5.8 | 65 |

**NOTES:**

1. In accordance with ISO 2635. AWG sizes are given for reference.

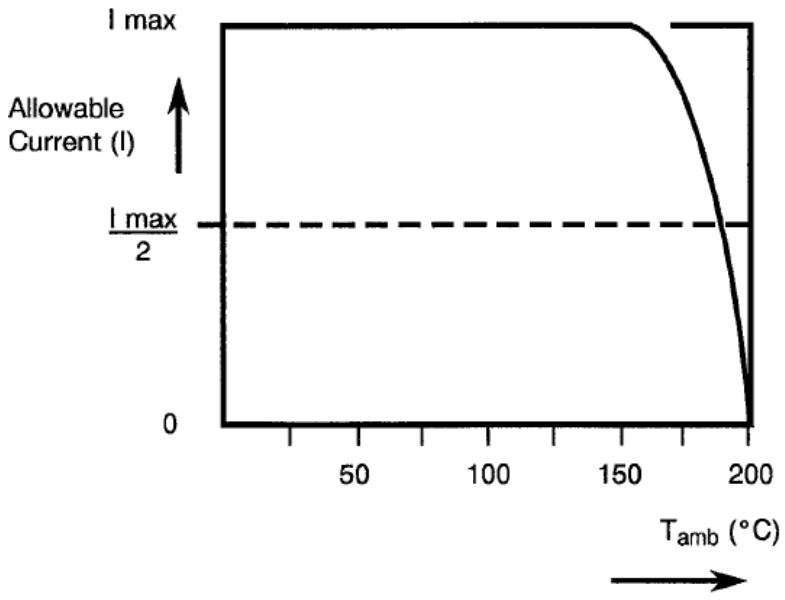
**TABLE 1(b) – MAXIMUM RATINGS**

| No. | Characteristics | Symbol | Maximum Rating | Unit | Remarks |
|---|---|---|---|---|---|
| 1 | Voltage | $V_P$ | 600 | $V_{rms}$ | |
| 2 | Maximum Current (each core) (Note 1) | $I_{max}$ | | A | For AWG: |
| | | | 1.3 | | 30 |
| | | | 1.5 | | 28 |
| | | | 2.5 | | 26 |
| | | | 3.5 | | 24 |
| | | | 5 | | 22 |
| | | | 7.5 | | 20 |
| | | | 10 | | 18 |
| | | | 13 | | 16 |
| | | | 23 | | 12 |
| 3 | Operating Temperature Range | $T_{amb}$ | -200 to +200 | °C | |
| 4 | Storage Temperature Range | $T_{stg}$ | -200 to +200 | °C | |

**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) – CORE

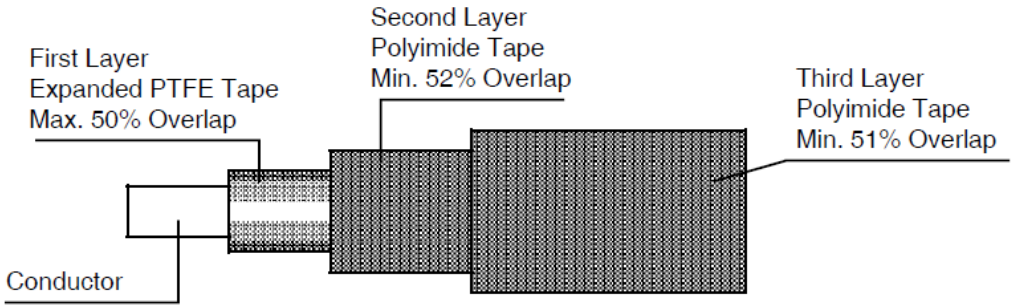



FIGURE 2(b) – SINGLE CORE CABLE WITH SHIELD AND JACKET

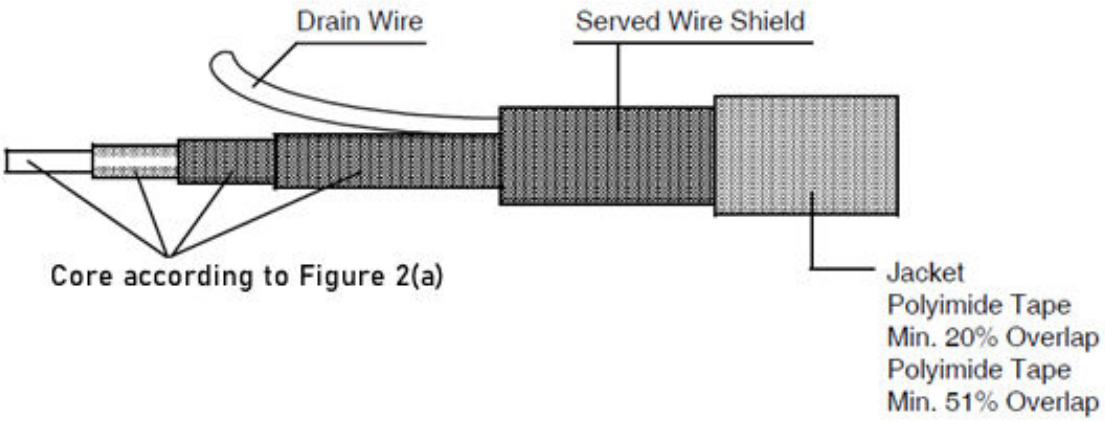
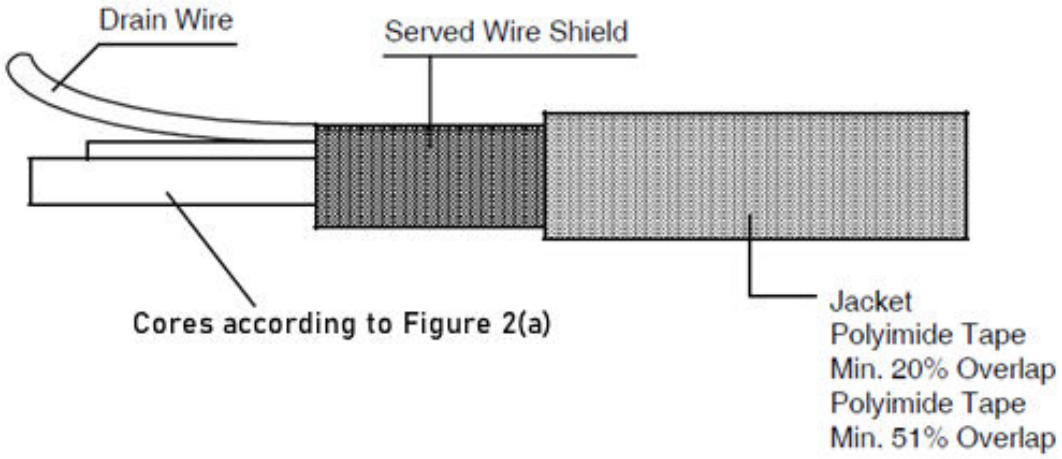



FIGURE 2(c) – MULTICORE CABLE WITH SHIELD AND JACKET



## 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, Cables, Electrical, 600V, Low Frequency.

(b) ISO 2635, Aircraft: Conductors for General Purpose Aircraft Electrical Cables and Aerospace Applications: Dimensions and Characteristics.

## 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 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 in accordance with 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 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 |
| Silver thickness | | | X |
| INSULATION | | | |
| Composition and Colour | | X | X |
| Thickness | | | X |
| Concentricity | | | X |
| Outer diameter | X | | |
| Core identification | | | X |
| Colour | | | X |
| SHIELDING | | | |
| Number of strands | X | | |
| Type of shielding | | | X |
| Strand diameter | X | | |
| Nature | | X | |
| Shield strand adhesion | | | X |
| Shielding lay | | | X |
| Shield coverage | | | X |
| DRAIN WIRE | | | |
| Nature | | | X |
| Outer diameter | X | | |
| Number of strands | X | | |
| Strand diameter | X | | |
| Length of lay | | | X |
| Silver thickness | | | X |
| JACKET | | | |
| Composition and Colour | | X | X |
| Protective tape wraps | | X | X |
| Thickness | | | X |
| Overlapping | | X | |
| Outer diameter | X | | |
| Colour | | | X |

4.3.2 Weight

The maximum weight of the 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 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, high strength copper alloy for ISO 004, 006, 012 and 030 and AWG 18, and silver-coated, high strength copper alloy for ISO 001 and 002 and AWG 28 to AWG 30 inclusive. On silver-coated strands, the thickness of the silver shall be 2µm minimum.

On all copper conductors, any strand shall show a 10% minimum elongation.

For high-strength copper alloy conductors, the tensile characteristics shall be 6% minimum in elongation and 35kg/mm$^2$ minimum in tensile strength.

For determination of the conductor resistance, as mentioned in Para 9.5 of ESCC Generic Specification No. 3901, 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 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 Core Insulation

*4.4.2.1 Material*

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

*4.4.2.2 Construction*

The insulation shall have a uniform cross-section throughout the length of the cables and the conductor shall be evenly centred in the insulation.

The insulation shall consist of 1 wrapped layer of expanded PTFE tape and 2 wrapped layers of polyimide tapes as specified in Figure 2(a).

4.4.3 Shield

*4.4.3.1 Material*

Shield strands shall meet the requirements for silver-coated, soft or annealed copper outlined in Para. 4.4.1.1 of this specification, but the thickness of silver shall be 2.5µm minimum.

*4.4.3.2 Construction*

Shields shall be closely and helically wound around the drain wire and the core(s) and provide not less than 92% coverage. The coverage factor K is calculated as follows:

$$K = \frac{n \times d_w \sqrt{(\pi D)^2 + P^2}}{P\pi D} \times 100(\%)$$

where:

- K = % coverage
- n = number of serving shield strands
- $d_w$ = shield strand diameter (mm)
- D = diameter of core (mm)
- P = serving pitch (mm)

4.4.4 Drain Wire

Material, construction, stranding as well as size of the drain wire shall be exactly the same as the conductor of a single core. It shall be placed underneath the served wire shield.

4.4.5 Jacket

All shielded cables shall be provided with jackets of wrapped polyimide tapes as specified in Figures 2(b) and 2(c). The wrapped tapes shall be heat-sealed. The side of the tape of the first layer above the shield, which is not coated with FEP resin, shall be facing the shield.

The jacket shall have an even wall thickness of 0.1mm.

4.4.6 Construction of Multicore Cables

Multicore cables shall be constructed by twisting the required number and size of cores to form a uniform cable without high strands, bends or other irregularities. Cores (and drain wire) of only one size shall be used for one cable. The cabling shall be with a left-hand lay and the length of lay shall not be less than 12, nor more than 16, times the outside diameter of the unshielded, unjacketed cable. The construction of shielded and jacketed cables is shown in Figures 2(b) and 2(c).

Fillers shall not be used in the construction of multicore cables except for the 5- and 6-core cables, where the 5/6 cores shall be twisted around a round, uncoloured filler made of expanded polytetrafluoroethylene. The diameter of the filler for the 5/6 core cables shall be 0.7/1 times the diameter of the cores used in the cable.

4.4.7 Colour Coding

*4.4.7.1 Single and Multicore Cable Colour Coding*

The colour coding of all cables be according to the following list, if not otherwise specified in the contract.

| No. of Cores in Cable | Colour of Respective Cores | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | red | natural | | | | | |
| 3 | red | natural | yellow | | | | |
| 4 | red | natural | yellow | green | | | |
| 5 | red | natural | yellow | green | brown | | |
| 6 | red | natural | yellow | green | brown | black | |
| 7 | red | natural | yellow | green | brown | black | orange |

*4.4.7.2 Jacket colour*
The colour of jackets shall normally be the natural colour of the polyimide tapes.

4.5 MARKING

4.5.1 General
The marking of all spools of 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:

(a) The ESCC qualified components symbol (for ESCC qualified components only).
(b) The ESCC Component Number (see Note 1)
(c) Traceability Information.
(d) Additional Marking.

**NOTES:**
1. Whenever more than one length of 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. 4.5.2.1(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:

Example: 390102101B100m

- Detail Specification Reference: 3901021
- Component Type Variant Number (see Table 1(a)): 01 (as required)
- Testing level (B is mandatory): B
- Characteristic code: cable length: 100m (as required; see Para. 4.5.2.1(a))

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

(a) Cable Length:
The required length of the cable wound on each spool expressed by means of the following codes. The unit quantity shall be metre (m).

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

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 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 ±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 Paras. 4.4.1.1 and 4.4.4 of this Specification.

4.8.2 Accelerated Ageing
Ageing Temperature: +230 ±5°C.

**TABLE A**
Not applicable

4.8.3 Wrap Test at Ambient Temperature

The mandrel diameters and applied loads for testing of cables are given in Table B.

**TABLE B – WRAP TEST AT AMBIENT TEMPERATURE / BLOCKING: MANDREL DIAMETERS AND LOADS FOR CABLES**

| Cable Size ISO/(AWG) | Number of Cores | Mandrel Diameter (mm) | Applied Weight (kg) |
|---|---|---|---|
| - /(30) | 1 | 10 | 0.15 |
| - /(28) | 1 | 15 | 0.25 |
| 001/(26) | 1 | 15 | 0.25 |
| 002/(24) | 1 | 15 | 0.25 |
| 004/(22) | 1 | 20 | 0.5 |
| 006/(20) | 1 | 25 | 0.5 |
| - /(18) | 1 | 30 | 1 |
| 012/(16) | 1 | 30 | 1 |
| 030/(12) | 1 | 40 | 1 |
| -/(30) | 2 | 20 | 0.25 |
| -/(28) | 2 | 20 | 0.5 |
| 001/(26) | 2 | 20 | 0.5 |
| 002/(24) | 2 | 25 | 0.5 |
| 004/(22) | 2 | 30 | 0.8 |
| 006/(20) | 2 | 35 | 0.8 |
| 012/(16) | 2 | 50 | 1 |
| 030/(12) | 2 | 60 | 1 |
| -/(30) | 3 | 15 | 0.25 |
| -/(28) | 3 | 20 | 0.5 |
| 001/(26) | 3 | 25 | 0.75 |
| 002/(24) | 3 | 30 | 0.75 |
| 004/(22) | 3 | 30 | 1.2 |
| 006/(20) | 3 | 40 | 1.2 |
| -/(30) | 4 | 20 | 0.5 |
| -/(28) | 4 | 25 | 0.8 |
| 001/(26) | 4 | 25 | 1 |
| 002/(24) | 4 | 30 | 1 |
| 004/(22) | 4 | 35 | 1.5 |
| 006/(20) | 4 | 40 | 1.5 |
| 001/(26) | 5 | 25 | 1.5 |
| 002/(24) | 5 | 30 | 1.5 |
| 004/(22) | 5 | 35 | 2 |
| 006/(20) | 5 | 40 | 2 |
| 001/(26) | 6/7 | 35 | 1.5 |
| 002/(24) | 6/7 | 30 | 1.5 |
| 004/(22) | 6/7 | 35 | 2 |
| 006/(20) | 6/7 | 40 | 2 |

4.8.4 Voltage Test

No particular conditions are applicable.

4.8.5 Shrinkage
The shrinkage temperature shall be +200 ±5°C.

4.8.6 Blocking
The blocking temperature shall be +230 ±5°C. The mandrel diameters and applied loads for testing of cables are given in Table B.

4.8.7 Cold Bend Test
The test shall be performed on all cores that have been extracted from the cable sample.

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

**TABLE C – COLD BEND TEST: MANDREL DIAMETERS AND LOADS FOR CORES**

| Wire Size ISO/(AWG) | Mandrel Diameter (mm) | Applied Weight (kg) |
|---|---|---|
| - /(30) | 5 | 0.15 |
| - /(28) | 6 | 0.25 |
| 001/(26) | 6 | 0.25 |
| 002/(24) | 6 | 0.25 |
| 004/(22) | 6 | 0.4 |
| 006/(20) | 6 | 0.4 |
| - /(18) | 10 | 0.5 |
| 012/(16) | 10 | 0.5 |
| 030/(12) | 20 | 1 |

4.8.8 Cut-through Resistance
The mean load measured during 9 tests shall not be less than the relevant value specified below:

| Wire Size ISO Requirements | - | - | 001 | 002 | 004 | 006 | - | 012 | 030 |
|---|---|---|---|---|---|---|---|---|---|
| (AWG) | (30) | (28) | (26) | (24) | (22) | (20) | (18) | (16) | (12) |
| Cut-through Load (kg) | 9 | 11 | 11 | 11 | 21 | 26 | 32 | 35 | 50 |

4.8.9 Notch Resistance
The depth of notch shall be 0.04mm.

4.8.10 Flammability Resistance
No particular conditions are applicable.

4.8.11 Resistance to Fluids
Tests (e), (f) and (g) 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 ISO Requirements | - | - | 001 | 002 | 004 | 006 | - | 012 | 030 |
|---|---|---|---|---|---|---|---|---|---|
| (AWG) | (30) | (28) | (26) | (24) | (22) | (20) | (18) | (16) | (12) |
| Scrape Abrasion (Load in grammes) | 350 | 500 | 650 | 750 | 800 | 900 | 900 | 1050 | 1200 |

4.8.14 Soldering
No particular conditions are applicable.

4.8.15 Solderability
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 and Brown Test
No particular conditions are applicable.

**TABLE 2 – ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE**

| No. | Characteristics | Specification and 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<br>Dry Test<br>Insulation: 3kV<br>Jacket: 1.5kV | No Breakdown | - |
| 3 | Voltage Test | ESCC No. 3901, Section 9 | Para. 9.7 | Para. 9.7 | kV |
| 4 | Insulation Resistance | ESCC No. 3901, Section 9 | Para. 9.8 | Insulation: ≥ 750<br>Jacket: ≥ 30 | MΩ.km<br>MΩ.km |
| 5 | Surface Resistance | ESCC No. 3901, Section 9 | Para. 9.22 | > 125 | MΩ.mm |