DOCUMENT CHANGE REQUEST

DCR number 170	Changes required for: General	Originator: S Thacker
Date: 2005/04/19	Date sent: 2005/04/19	Organisation: ESA/ESTEC
Status: IMPLEMENTED		

Title:	Polyimide Insulated Wires and Cables Low Frequency 600V -150 to +150 degree C, based on type		
Number:	3901/007	Issue:	1

Other documents affected:

3901/008-1, 3901/009-1

Page:

Page 1 Spec title
Page 5 para 1.1
Page 9 Table 1(b)
Page 9 Figure 1
plus editorial changes throughout the spec

Paragraph:

Page 1 Spec title
Page 5 para 1.1
Page 9 Table 1(b)
Page 9 Figure 1
plus editorial changes throughout the spec

Original wording:

Proposed wording:

(See attached mark-up)

1) Spec Title, para 1.1, Table 1(b) item No.3 & 4:
Amend temperature range to be -200 to +200 degC (was -150 to +150 degC)

2) Figure 1
Amend the figure such that the current derating curve intersects the X-axis at +200degC (was +150degC). X-axis values to be adjusted accordingly (see mark-up attached for details).

3) Editorial changes
Amend the specification to reflect ESCC format i.e use new DCN page, change the ESA/SCC logo & amend "ESA/SCC" to read "ESCC" throughout.

Justification:

The original specification for this wire incorrectly defined the temperature rating. This change brings these 3 specs in to line with the ESCC specifications for other wire that uses the same material and construction e.g 3901/019 which has a

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temperature rating of -200 to +200 DegC.

Attachments:

DCR_Markup_3901009.pdf, null

Modifications:

N/A

Approval signature:

Date signed:

2005-04-19

DCR MARK-UP
PAGES. DCR116
S. Thacker.
12/4/05.

POLYIMIDE INSULATED WIRES AND CABLES, LOW FREQUENCY, 600V, -~~150~~ -200 TO ~~+150~~ +200 °C, BASED ON TYPE SPC 2110

ESCC Detail Specification No. 3901/009

ISSUE ~~1~~ 2

~~October 2002~~

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

ESCC LOGO

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
		This Issue supersedes Issue 1 and incorporates all modifications defined in Revisions 'A' and 'B' to Issue 1 and the changes agreed in the following DCR's:-		
		Cover Page		None
		DCN		None
		Para. 2	: Reference to MIL-STD-104 added	23791
		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. 4.4.3.2	: 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

DCR No	CHANGE DESCRIPTION
116	Specification up issued to incorporate editorial and technical changes per DCR

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, ~~−150~~ −200 to ~~+150~~ +200 °C, based on Type SPC 2110. It shall be read in conjunction with ~~ESA/SCC~~ ESCC 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.

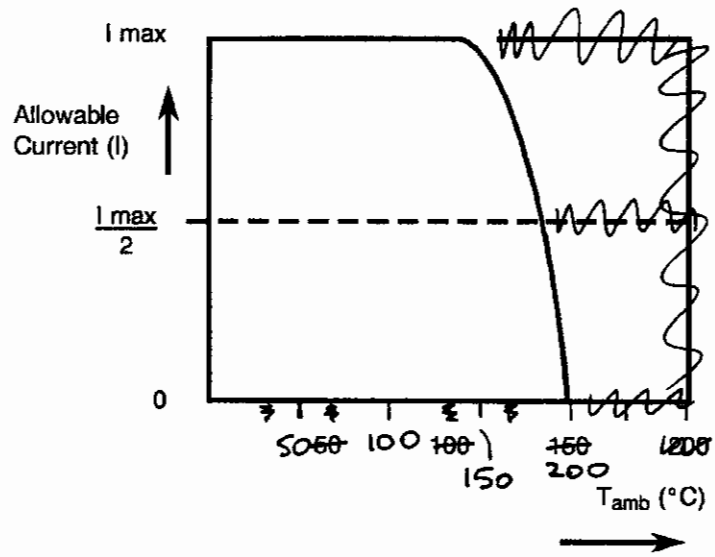
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Voltage	V_P	600	Vrms	
2	Maximum Current (Note 1)	I_{max}	1.5 2.5 3.5 5.0 7.5 13.0 25.0	A	For AWG 28 26 24 22 20 16 12
3	Operating Temperature Range	T_{amb}	~~−150~~ −200 to ~~+150~~ +200	°C	
4	Storage Temperature Range	T_{stg}	~~−150~~ −200 to ~~+150~~ +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



See drawing in 3901/019 Figure 1

Allowable Current versus Temperature

2. APPLICABLE DOCUMENTS

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

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

(b) MIL-STD-104, "Limits for Electrical Insulation Coloured".

3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ~~ESA/SCC~~ ESCC Basic Specification No. 21300 and ~~ESA/SCC~~ ESCC 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~~ 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 ~~ESA/SCC~~ 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.

4.4 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 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 silver shall be 2.0 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/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~~ 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 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 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 have a uniform cross-section throughout the length of the cable and the conductor shall be evenly centred in the insulation.

The insulation shall consist of 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 annealed copper as outlined in Para. 4.4.1.1 of this specification, but the thickness of silver shall be 2.5 microns minimum.

- Red
- Orange (not preferred)
- Yellow
- Green
- Natural

The colour of top wraps shall conform to the colour limits specified in MIL-STD-104, Class 1.

4.4.6.2 Multicore Cable Colour-coding

If the contract does not define any specific colour-coding, all individual cores in multicore cables shall have the natural colour. If colour-coding is desired, it is proposed that the individual cores in such cables shall be coloured according to the following scheme:-

Number 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

4.4.6.3 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 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:-

390100902B

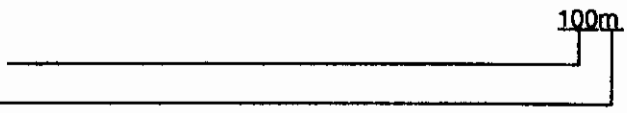
Detail Specification Number

Type Variant (see Table 1(a))

Testing Level

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.

ESCC

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 $+230 \pm 5$ °C.

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

4.8.13 Abrasion Resistance

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

Wire Size (AWG)	28	26	24	22	20	16	12
Scrape Abrasion Load (g)	500	650	750	800	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	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

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