PFA INSULATED SOLID WIRES

FOR WIRE WRAPPING

350V, -100 TO +200°C

BASED ON TYPE FA 3903-WP

ESCC Detail Specification No. 3903/002

ISSUE 1

October 2002

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

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space components
coordination group

Issue/Rev.	Date	Approved by	
		SCCG Chairman	ESA Director General or his Deputy
Issue 1	March 1994		
Revision 'A'	September 1995		

DOCUMENTATION CHANGE NOTICE

Rev. Letter	Rev. Date	Reference	CHANGE Item	Approved DCR No.
'A'	Sept. '95	P1. Cover page P2. DCN P14. Para. 4.8.11	: Test references amended	None None 23762

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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 PFA Insulated solid wires for wire wrapping, 350V, −100 to +200°C, based on Type FA 3903-WP. It shall be read in conjunction with ESA/SCC Generic Specification No. 3903, the requirements of which are supplemented herein.

N.B.
These wires shall not be used in the presence or vicinity of hydrazine or nitrogen tetroxide.

1.2 COMPONENT TYPE VARIANTS

Variants of the basic type of wires specified herein, which are also covered by this specification, are given in Table 1(a).

1.3 MAXIMUM RATINGS

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

1.4 PARAMETER DERATING INFORMATION

The derating information applicable to the finished wires is given in Table 1(b) and Figure 1.

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

1.6 FUNCTIONAL DIAGRAM

Not applicable.

TABLE 1(a) - TYPE VARIANTS

VARIANT	NUMBER OF WIRES	WIRE SIZE	MATERIAL		CONDUCTOR			INSULATION		MAX. WEIGHT	MAX. DIAMETER FOR TWISTED PAIRS
			COPPER	COPPER ALLOY	DIAMETER	NOMINAL SECTION	MAXIMUM OHMIC RESIST.	DIAMETER	INSULATION PULL-OFF FORCE		
		(AWG)			(mm)	(mm^2)	(Ω/km)	(mm)	(N)	(kg/km)	(mm)
01	1	30		X	0.254 ± 0.01	0.05	415	0.53 ± 0.03	1.4 to 7	0.95	-
02	1	28		X	0.32 ± 0.01	0.08	260	0.62 ± 0.03	1.8 to 9	1.35	-
03	1	26	X		0.40 ± 0.01	0.13	140	0.74 ± 0.03	2.4 to 12	2.00	-
04	2	30		X	0.254 ± 0.01	0.05	436	0.53 ± 0.03	1.4 to 7	2.00	1.12
05	2	28		X	0.32 ± 0.01	0.08	273	0.62 ± 0.03	1.8 to 9	2.85	1.30
06	2	26	X		0.40 ± 0.01	0.13	147	0.74 ± 0.03	2.4 to 12	4.15	1.54

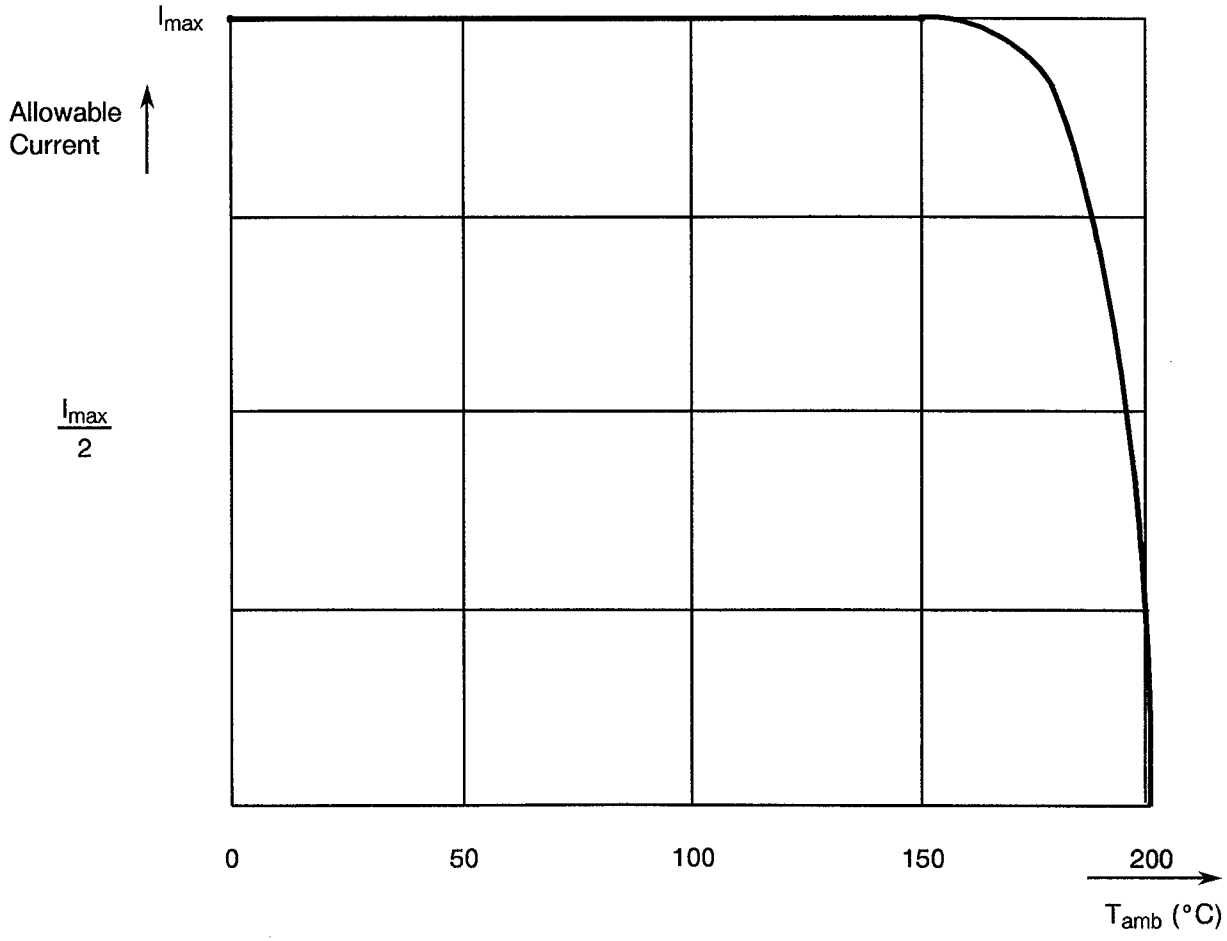
TABLE 1(b) - MAXIMUM RATINGS

No.	CHARACTERISTICS	SYMBOL	MAXIMUM RATINGS	UNIT	REMARKS
1	Voltage	V_P	350	Vrms	-
2	Maximum Current For AWG 30 For AWG 28 For AWG 26	I_{max}	 1.0 1.5 2.5	A	Note 1
3	Operating Temperature Range	T_{amb}	−100 to +200	°C	-
4	Storage Temperature Range	T_{stg}	−100 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

FIGURE 2(a) - FINISHED WIRE

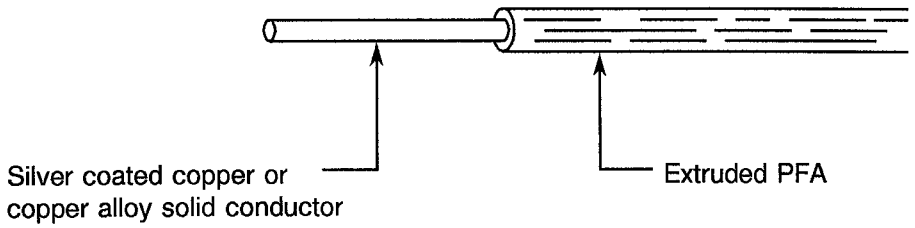
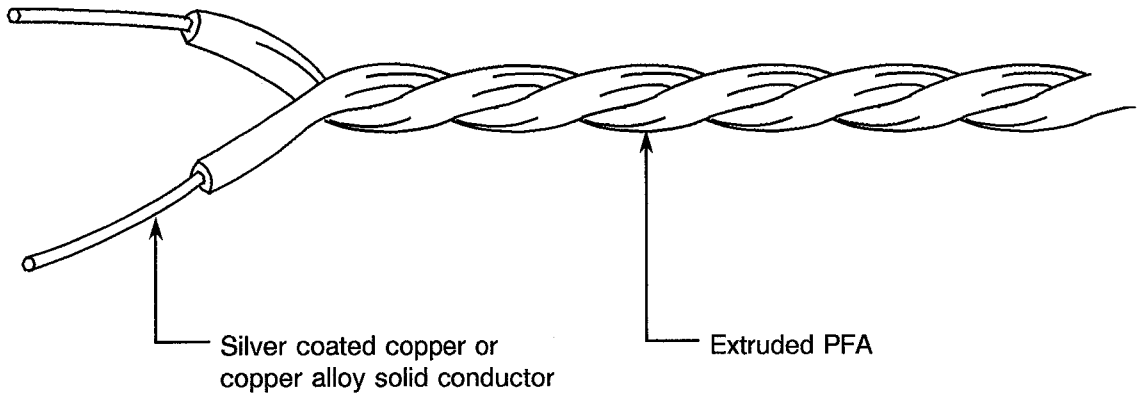


FIGURE 2(b) - TWISTED PAIR ASSEMBLY



NOTES

1. For dimensions, see Table 1(a).

2. APPLICABLE DOCUMENTS

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

- ESA/SCC Generic Specification No. 3903, Solid Wires, Electrical, 350V, for Wire Wrapping.

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. 3903 shall apply.

4. REQUIREMENTS

4.1 GENERAL

The complete requirements for procurement of the finished wires specified herein are stated in this specification and ESA/SCC Generic Specification No. 3903. 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)

None.

4.2.3 Deviations from Burn-in Tests (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 assemblies 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)	PARA 4.4
COMPOSITION		
Number of conductors	X	
Gauge	X	
CONDUCTOR		
Nature		X
Outer diameter	X	
Silver thickness		X
INSULATION		
Nature		X
Concentricity		X
Outer diameter	X	
ASSEMBLY		
Length of lay		X
Max. diameter	X	

4.3.2 Weight

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

4.3.3 Stripping Capability (Insulation Pull Off Force)

It shall be possible to strip 40mm of insulation with a force which does not exceed that shown 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 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 wire used in the manufacture of the conductors shall be silver-coated, soft or annealed, oxygen-free high conductivity copper for AWG 26, high strength copper alloy from AWG 28 and 30.

The thickness of silver shall be 2.0µm minimum.

For copper conductors, the tensile characteristics shall be not less than 15% in elongation and from 220 to 294 N per square mm in tensile strength.

For high-strength copper alloy conductors, the tensile characteristics shall be not less than 6% and not more than 15% in elongation and 35kg per square mm in tensile strength.

For determination of the conductor resistance at +20°C, as mentioned in Para 9.5 of ESA/SCC Generic Specification No. 3903, the "α" coefficient for copper alloy is 0.0035.

4.4.2 Insulation

4.4.2.1 Material

Any insulating material shall be virgin Perfluoroalkoxy (PFA) with only those additives that are necessary to incorporate the insulation material to obtain the colour required.

4.4.2.2 Construction

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

At any cross-section along the length of the completed wire, the minimum thickness of the insulation shall not be less than 70% of the maximum thickness at that cross-section.

4.4.2.3 Insulation Colour

The insulation colour is prescribed in relation to the wire size as shown in the table of Para. 4.4.4.

4.4.3 Assembly

4.4.3.1 Construction

A twisted pair shall be constructed by assembly of 2 cores which are left hand laid concentrically. The length of lay shall be not less than 10, nor more than 14 times, the maximum multicore assembly diameter.

4.4.4 Colour Identification Code

The colour identification code for insulation shall be as specified in the following table.

COLOUR IDENTIFICATION CODE

Wire Size (AWG)	Single Wire	Twisted Pairs
30	Red	White + Red
28	Blue	White + Blue
26	Yellow	White + Yellow

4.5 MARKING

4.5.1 General

The marking of all spools of finished wires 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.

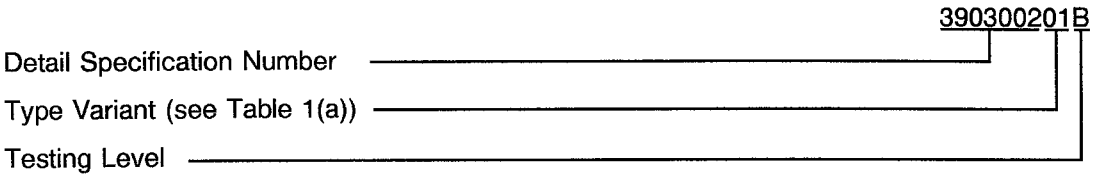
(b) Characteristics.

(c) Traceability Information.

(d) Additional Marking.

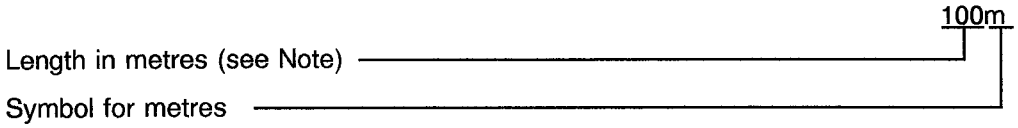
4.5.2 The SCC Component Number

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 the finished wire or assembly wound on one spool and shall be marked as follows:-



N.B.
Whenever the length is less than 100 metres, insert a zero in the first block (e.g.: 075m). If more than 1 length of finished wire or assembly 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 Manufacturer's Quality Control Inspector's stamp.

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 (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 3903)

4.8.1 Mechanical Properties of Conductor

As detailed in Para. 4.4.1 of this specification.

4.8.2 Accelerated Ageing

TABLE A - MANDREL DIAMETERS AND LOADS FOR FINISHED WIRES

Wire Size (AWG)	Mandrel Diameter (mm)	Weight (kg)
30	4.0	0.10
28	5.0	0.20
26	6.0	0.25

4.8.3 Wrap Test at Room Temperature

TABLE B - MANDREL DIAMETERS AND LOADS FOR TWISTED PAIRS

Wire Size (AWG)	Mandrel Diameter (mm)	Applied Weight (kg)
30	8.0	0.20
28	10.0	0.35
26	12.0	0.50

For finished wires, see Para. 4.8.2, Table A.

4.8.4 Voltage Test

No particular conditions are applicable.

4.8.5 Shrinkage

No particular conditions are applicable.

4.8.6 Blocking

No particular conditions are applicable.

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

Wire Size (AWG)	Mandrel Diameter (mm)	Weight (kg)
30	4.0	0.10
28	5.0	0.20
26	6.0	0.25

4.8.8 Cut-through Resistance

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

Wire Size (AWG)	30	28	26
Cut-through Load (kg)	0.8	1.0	1.2

4.8.9 Notch Resistance

The depth of notch shall be 0.08mm.

4.8.10 Flammability Resistance

No particular conditions are applicable, except that the test shall be performed on a bundle made of a minimum of 4 wires.

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 (AWG)	30	28	26
Scrape Abrasion (Load in grammes)	200	250	300

4.8.14 Radiation Resistance

No particular conditions are applicable.

4.8.15 Long-term Ageing Test

No particular conditions are applicable.

TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE

No.	CHARACTERISTICS	ESA/SCC 3903 TEST METHOD AND CONDITIONS	LIMITS	UNIT
1	Conductor Resistance	Para. 9.5	Table 1(a)	Ω/km
2	Spark Test	Para. 9.6	2.0	kV
3	Voltage Test	Para. 9.7	1.5	kV
4	Insulation Resistance	Para. 9.8	750	M.Ω.km
5	Surface Resistance	Para. 9.22	125	M.Ω.mm