



BSI Standards Publication

Aerospace series — Cables, electrical, for general purpose, single and multicore assembly — XLETFE Family

Part 005: Silver plated copper — Operating temperatures, between $-65\text{ }^{\circ}\text{C}$ and $150\text{ }^{\circ}\text{C}$ — Single extruded wall for enclosed applications — UV laser printable — Product standard

National foreword

This British Standard is the UK implementation of EN 4611-005:2012.

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A list of organizations represented on this committee can be obtained on request to its secretary.

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NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2012

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English Version

**Aerospace series - Cables, electrical, for general purpose,
single and multicore assembly - XLETFE Family - Part 005:
Silver plated copper - Operating temperatures, between -65 °C
and 150 °C - Single extruded wall for enclosed applications - UV
laser printable - Product standard**

Série aérospatiale - Câbles, électriques, d'usage général,
mono et multiconducteurs - Famille XLETFE - Partie 005 :
Cuivre argenté - Températures de fonctionnement
comprises entre -65 °C et 150 °C - Fil simple isolé pour
applications internes - Marquable au laser UV - Norme de
produit

Luft- und Raumfahrt - Ein- und mehradrige elektrische
Leitungen zur allgemeinen Verwendung, XLETFE-Familie -
Teil 005: Kupfer versilbert, Betriebstemperaturen zwischen
-65 °C und 150 °C, einfach extrudierte Isolierung für
umschlossene Anwendungen, UV-Laser bedruckbar -
Produktnorm

This European Standard was approved by CEN on 17 September 2011.

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Foreword

This document (EN 4611-005:2012) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.

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1 Scope

This European Standard specifies the characteristics of UV laser printable, silver plated copper conductor, electrical cables Crosslinked Ethylene Tetra Fluoro Ethylene co-polymer XLETFE family for use in the on-board electrical systems of aircraft at operating temperatures between –65 °C and 150 °C, operating at voltages not exceeding 600 V r.m.s and frequencies not exceeding 2 000 Hz. These cables are for enclosed applications e.g. within equipment or conduit; they are only suitable for open airframe use when provided with additional protection against mechanical abuse. In case of conflict between this European Standard and other referenced documents this European Standard should take precedence.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 2083, *Aerospace series – Copper or copper alloys conductors for electrical cables – Product standard*

EN 2084, *Aerospace series – Cables, electric, single-core, general purpose, with conductors in copper or copper alloy – Technical specification*

EN 2235, *Aerospace series – Single and multicore electrical cables, screened and jacketed*

EN 3475-100¹, *Aerospace series – Cables, electrical, aircraft use – Test methods – Part 100: General*

EN 4611-002, *Aerospace series – Cables, electrical, for general purpose, single and multicore assembly – XLETFE Family – Part 002: General*

EN 9133, *Aerospace series – Quality management systems – Qualification procedure for aerospace standard parts*

3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the terms, definitions, symbols and abbreviations given in EN 3475-100 apply.

¹ And all its parts.

4 Materials and construction

4.1 Materials

Conductor

The cable conductors shall be made of silver plated copper according EN 4611-002 and EN 2083 code C.

Insulation for conductor all size codes

Single layer of extruded XLETFE

For single core, it shall be possible to mark the outer insulation by UV laser printing.

4.2 Construction

See EN 4611-002, Table 1 and Table 2.

Table 1 – Single core cables

Code for nominal section	Nominal section mm ²	AWG ^a	Linear resistance at 20 °C Ω/km max.	External diameter		Mass kg/km max.	Minimum insulation thickness mm
				mm min.	mm max.		
001 ^b	0,15	26	149,0	0,72	0,82	1,88	0,13
002 ^b	0,25	24	106,0	0,81	0,91	2,57	0,13
004	0,4	22	55,3	0,98	1,08	3,98	0,13
006	0,6	20	31,0	1,19	1,35	6,54	0,13
010	1	18	19,6	1,44	1,59	9,81	0,13
012	1,2	16	14,9	1,56	1,82	13,27	0,13
020	2	14	10,2	1,93	2,29	19,57	0,13
030	3	12	6,4	2,37	2,74	30,35	0,13

^a AWG = Closest American Wire Gauge.
^b Silver plated copper alloy conductor

Table 2 – Multicore without screen or jacket

Size	AWG ^a	2 core			3 core			4 core		
		Max. dia. mm	Mass max. kg/km	DC Res. Ω /km max.	Max. dia. mm	Mass max. kg/km	DC Res. Ω /km max.	Max. dia. mm	Mass max. kg/km	DC Res. Ω /km max.
001 ^b	26	1,64	3,83	153,5	1,77	5,74	153,5	1,98	7,65	153,5
002 ^b	24	1,82	5,20	109,2	1,97	7,90	109,2	2,20	10,39	109,2
004	22	2,16	8,04	60,0	2,33	12,05	60,0	2,61	16,07	60,0
006	20	2,70	13,23	31,9	2,92	19,84	31,9	3,27	26,46	31,9
010	18	3,18	19,81	20,2	3,43	29,72	20,2	3,85	39,63	20,2
012	16	3,64	25,33	15,3	3,93	38,00	15,3	4,40	50,67	15,3
020	14	4,58	39,52	10,5	4,95	59,29	10,5	5,54	79,05	10,5
030	12	5,48	61,61	6,6	5,92	92,41	6,6	6,63	123,22	6,6

^a AWG = Closest American Wire Gauge.
^b Silver plated copper alloy conductor

4.3 Number of cores

See EN 4611-002.

See EN 2235 for cabling.

4.4 Colour coding of cores

See EN 4611-002.

5 Required characteristics

According to EN 2084 and EN 3475-100

See Table 3.

NOTE Tests EN 3475-302 to EN 3475-706 should be performed on the single core cables.

Table 3

EN 3475-	Test	Details
201	Visual examination	Applicable
202	Mass	Applicable; see Table 1 and Table 2.
203	Dimensions	Applicable; see Table 1 and Table 2.
301	Ohmic resistance per unit length	Applicable; see Table 1 and Table 2.
302	Voltage proof test	Applicable
303	Insulation resistance	Applicable (20 ± 2) °C, 500 MΩ.km minimum (95 ± 2) °C, 1 MΩ.km minimum
304	Surface resistance	Applicable 12 500 MΩ.mm minimum
305	Overload resistance	Applicable $T_1 = (250 \pm 5) \text{ °C}$; $T_2 = (380 \pm 5) \text{ °C}$
401	Accelerated ageing	Applicable Temperature (200 ± 3) °C
402	Shrinkage and delamination	Applicable Temperature (150 ± 5) °C Maximum shrinkage at each end of cable: 0,80 mm on size code 001 to 006 1,00 mm on size code 012 to 012 1,20 mm on size code 020 to 050
403	Delamination and blocking	Applicable Temperature (150 ± 5) °C
404	Thermal shock	Applicable Temperatures (– 65 ± 2) °C and (260 ± 5) °C Maximum shrinkage at each end of cable: 1,00 mm on size code 001 to 050
405	Bending at ambient temperature	Applicable
406	Cold bend test	Applicable Temperature (– 65 ± 2) °C
407	Flammability	Applicable Methods 1 and 2 Flame application 15 s Extinguishing time: 3 s max.
408	Fire resistance	Not applicable
409	Air-excluded ageing	Not applicable
410	Thermal endurance	Applicable 50 000 hours Temperature 150 °C
411	Resistance to fluids	Applicable
412	Humidity resistance	Applicable Method B Temperature (90 ± 2) °C Duration 672 hours

(continued)

Table 3 (continued)

EN 3475-	Test	Details																											
413	Wrap back test	Not applicable																											
414	Differential scanning calorimeter (DSC test)	Not applicable																											
501	Dynamic cut-through	<p>Applicable single core Temperature (150 ± 3) °C</p> <table border="1"> <thead> <tr> <th>Size code</th> <th>Nominal section mm²</th> <th>Cut-through force N</th> </tr> </thead> <tbody> <tr><td>001</td><td>0,15</td><td>7,5</td></tr> <tr><td>002</td><td>0,25</td><td>10</td></tr> <tr><td>004</td><td>0,40</td><td>15</td></tr> <tr><td>006</td><td>0,60</td><td>15</td></tr> <tr><td>010</td><td>1,00</td><td>15</td></tr> <tr><td>012</td><td>1,20</td><td>15</td></tr> <tr><td>020</td><td>2,00</td><td>15</td></tr> <tr><td>030</td><td>3,00</td><td>15</td></tr> </tbody> </table>	Size code	Nominal section mm ²	Cut-through force N	001	0,15	7,5	002	0,25	10	004	0,40	15	006	0,60	15	010	1,00	15	012	1,20	15	020	2,00	15	030	3,00	15
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012	1,20	15																											
020	2,00	15																											
030	3,00	15																											
502	Notch propagation	Not applicable																											
503	Scrape abrasion	<p>Applicable single core Temperature (150 ± 3) °C Minimum number of cycles = 50</p> <table border="1"> <thead> <tr> <th>Size code</th> <th>Nominal section mm²</th> <th>Load N</th> </tr> </thead> <tbody> <tr><td>001</td><td>0,15</td><td>2,0</td></tr> <tr><td>002</td><td>0,25</td><td>3,0</td></tr> <tr><td>004</td><td>0,40</td><td>3,5</td></tr> <tr><td>006</td><td>0,60</td><td>4,0</td></tr> <tr><td>010</td><td>0,95</td><td>4,5</td></tr> <tr><td>012</td><td>1,35</td><td>5,0</td></tr> <tr><td>020</td><td>1,80</td><td>5,5</td></tr> <tr><td>030</td><td>3,00</td><td>6,0</td></tr> </tbody> </table>	Size code	Nominal section mm ²	Load N	001	0,15	2,0	002	0,25	3,0	004	0,40	3,5	006	0,60	4,0	010	0,95	4,5	012	1,35	5,0	020	1,80	5,5	030	3,00	6,0
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030	3,00	6,0																											
504	Torsion	Not applicable																											
505	Tensile test on conductors and strands	Applicable																											
506	Plating continuity	Applicable																											
507	Adherence of plating	Applicable																											
508	Plating thickness	Applicable																											
509	Solderability	Applicable Wetting time 1 s max.																											

(continued)

Table 3 (concluded)

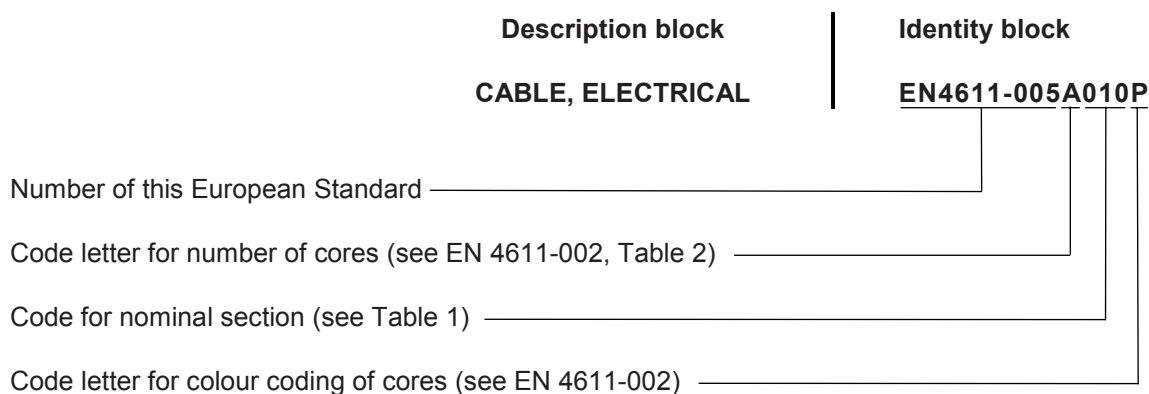
EN 3475-	Test	Details																																				
510	Tensile strength and elongation of extruded insulation, sheath and jacket material	Applicable																																				
511	Cable to cable abrasion	Not applicable																																				
512	Flexure endurance	Applicable code 006 Mandrel \varnothing 15 mm Weight 0,75 kg – 750 cycles																																				
601	Smoke density	Applicable code 006 $D_s < 50$, 4 minutes																																				
602	Toxicity	Applicable code 006																																				
603	Resistance to wet arc tracking	Not applicable																																				
604	Resistance to dry arc propagation	Not applicable																																				
605	Wet short circuit test	Not applicable																																				
701	Strippability and adherence of insulation to the conductor	Applicable <table border="1"> <thead> <tr> <th>Size code</th> <th>Nominal section mm²</th> <th>min. N</th> <th>max. N</th> </tr> </thead> <tbody> <tr> <td>001</td> <td>0,15</td> <td>5,0</td> <td>20</td> </tr> <tr> <td>002</td> <td>0,25</td> <td>5,0</td> <td>20</td> </tr> <tr> <td>004</td> <td>0,40</td> <td>5,0</td> <td>25</td> </tr> <tr> <td>006</td> <td>0,60</td> <td>8,5</td> <td>25</td> </tr> <tr> <td>010</td> <td>1</td> <td>12,5</td> <td>30</td> </tr> <tr> <td>012</td> <td>1,2</td> <td>12,5</td> <td>30</td> </tr> <tr> <td>020</td> <td>2</td> <td>12,5</td> <td>35</td> </tr> <tr> <td>030</td> <td>3</td> <td>15</td> <td>35</td> </tr> </tbody> </table>	Size code	Nominal section mm ²	min. N	max. N	001	0,15	5,0	20	002	0,25	5,0	20	004	0,40	5,0	25	006	0,60	8,5	25	010	1	12,5	30	012	1,2	12,5	30	020	2	12,5	35	030	3	15	35
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020	2	12,5	35																																			
030	3	15	35																																			
702	Screen pushback capability	Not applicable																																				
703	Permanence of manufacturer's marking	Applicable																																				
704	Flexibility	Method 2 <table border="1"> <thead> <tr> <th>Size code</th> <th>Nominal section mm²</th> <th>Force N</th> <th>Recoil Deg.</th> <th>Mandrel mm</th> </tr> </thead> <tbody> <tr> <td>001</td> <td>0,15</td> <td>20</td> <td>70</td> <td>15</td> </tr> <tr> <td>002</td> <td>0,20</td> <td>20</td> <td>70</td> <td>15</td> </tr> <tr> <td>004</td> <td>0,40</td> <td>25</td> <td>60</td> <td>15</td> </tr> <tr> <td>006</td> <td>0,60</td> <td>25</td> <td>60</td> <td>15</td> </tr> </tbody> </table>	Size code	Nominal section mm ²	Force N	Recoil Deg.	Mandrel mm	001	0,15	20	70	15	002	0,20	20	70	15	004	0,40	25	60	15	006	0,60	25	60	15											
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006	0,60	25	60	15																																		
705	Contrast measurement	Applicable Laser marking $K \geq 50$ %																																				
706	Laser markability	Not applicable																																				

6 Quality assurance

See EN 9133.

7 Designation

EXAMPLE :



8 Identification and marking

See EN 4611-002.

9 Packaging, labelling and delivery lengths

See EN 2084.

10 Technical specification

See EN 2084.

See EN 2235.

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