BS EN 4611-009:2012

BSI Standards Publication

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

Part 009: BJ — Nickel plated copper — Operating temperatures, between –65 °C and 150 °C — Single extruded wall for use as cable cores or within equipment in areas of high vibtrations, cable flexing and fluid contamination — UV laser printable — Product Standard

National foreword

This British Standard is the UK implementation of EN 4611-009:2012.

The UK participation in its preparation was entrusted to Technical Committee ACE/6, Aerospace avionic electrical and fibre optic technology.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Aerospace series - Cables, electrical, for general purpose, single and multicore assembly - XLETFE Family - Part 009: BJ - Nickel plated copper - Operating temperatures, between -65 °C and 150 °C - Single extruded wall for use as cable cores or within equipment in areas of high vibration, cable flexing and fluid contamination - UV laser printable - Product standard

Série aérospatiale - Câbles, électriques, d'usage général, mono et multiconducteurs - Famille XLETFE - Partie 009 : BJ - Cuivre nickelé - Températures de fonctionnement comprises entre -65 °C et 150 °C - Fil simple isolé utilisé comme âme de câbles ou dans les équipements dans les zones à hautes vibrations, flexion de câbles et pollution des fluides - Marquable au laser UV - Norme de produit

Luft- und Raumfahrt - Ein- und mehradrige elektrische Leitungen zur allgemeinen Verwendung, XLETFE-Familie - Teil 009: BJ, Kupfer vernickelt, Betriebstemperaturen zwischen -65 °C und 150 °C, einfach extrudierte Isolierung zur Verwendung in Verseilungen oder in Geräten in Bereichen mit hoher Vibration, Bewegung der Leitung und Kontakt mit Flüssigkeiten, UV-Laser bedruckbar - Produktnorm

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

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 4611-009:2012) 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, nickel 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 ºC and 150 ºC, operating at voltages not exceeding 600 V r.m.s and frequencies not exceeding 2 000 Hz. These cables are intended for use as cores for jacketed cables or within equipment in areas where combinations of high vibration, cable flexing and fluid contamination are normal. In case of conflict between this European Standard and other referenced documents the requirements of 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 3475-100[1], *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 nickel plated copper according to EN 4611-002 and EN 2083 code D.

Insulation for conductor all size codes

— 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 and Table 1.

Table 1 – Single core cables

Code for nominal section	Nominal section	AWG [a]	Linear resistance at 20 °C	Maximum external diameter	Mass	Minimum insulation thickness
	mm^2		Ω/km max.	mm	kg/km max.	mm
002 [b]	0,25	24	114,0	0,94	2,76	0,13
004	0,4	22	60,0	1,08	3,90	0,13
006	0,6	20	33,2	1,35	6,67	0,13
010	1	18	21,1	1,59	10,30	0,13

[a] AWG = Closest American Wire Gauge.

[b] Nickel 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 2.

NOTE Tests EN 3475-302 to EN 3475-706 are only performed on the single core cable.

Table 2

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 ± 5) °C; T_2 = (380 ± 5) °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 002 to 006 1,00 mm on size code 010
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
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 180 °C
411	Resistance to fluids	Applicable No crazing or delamination, 5 % maximum swell, colour changes or removal of marking
412	Humidity resistance	Applicable Method B Temperature (90 ± 2) °C Duration 672 hours
413	Wrap back test	Not applicable
414	Differential scanning calorimeter (DSC test)	Not applicable

(continued)

Table 2 *(continued)*

<table>
<tr><th>EN 3475-</th><th>Test</th><th>Details</th></tr>
<tr><td>501</td><td>Dynamic cut-through</td><td>Applicable single core
Temperature (135 ± 3) °C
<table><tr><th>Size code</th><th>Nominal section
mm²</th><th>Cut-through force
N</th></tr><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></table></td></tr>
<tr><td>502</td><td>Notch propagation</td><td>Not applicable</td></tr>
<tr><td>503</td><td>Scrape abrasion</td><td>Applicable
Temperature (20 ± 3) °C
Minimum number of cycles for size 002 > 100
All other sizes > 150
<table><tr><th>Size code</th><th>Nominal section
mm²</th><th>Load
N</th></tr><tr><td>002</td><td>0,25</td><td>8,0</td></tr><tr><td>004</td><td>0,4</td><td>8,0</td></tr><tr><td>006</td><td>0,6</td><td>8,0</td></tr><tr><td>010</td><td>1</td><td>8,0</td></tr></table></td></tr>
<tr><td>504</td><td>Torsion</td><td>Not applicable</td></tr>
<tr><td>505</td><td>Tensile test on conductors and strands</td><td>Applicable</td></tr>
<tr><td>506</td><td>Plating continuity</td><td>Applicable</td></tr>
<tr><td>507</td><td>Adherence of plating</td><td>Applicable</td></tr>
<tr><td>508</td><td>Plating thickness</td><td>Applicable</td></tr>
<tr><td>509</td><td>Solderability</td><td>Not applicable</td></tr>
<tr><td>510</td><td>Tensile strength and elongation of extruded insulation, sheath and jacket material</td><td>Applicable
35 MPa and 75 %</td></tr>
<tr><td>511</td><td>Cable-to-cable abrasion</td><td>Not applicable</td></tr>
<tr><td>512</td><td>Flexure endurance</td><td>Not applicable</td></tr>
<tr><td>601</td><td>Smoke density</td><td>Applicable code 006
D_s < 50, 4 minutes</td></tr>
<tr><td>602</td><td>Toxicity</td><td>Applicable code 006</td></tr>
<tr><td>603</td><td>Resistance to wet arc tracking</td><td>Applicable or use EN 3475-605 as an alternative
Wire damage ≤ 70 mm
75 % of collateral wires must not be open circuit wet dielectric voltage proof test (EN 3475-302) not applicable</td></tr>
</table>

(continued)

Table 2 *(concluded)*

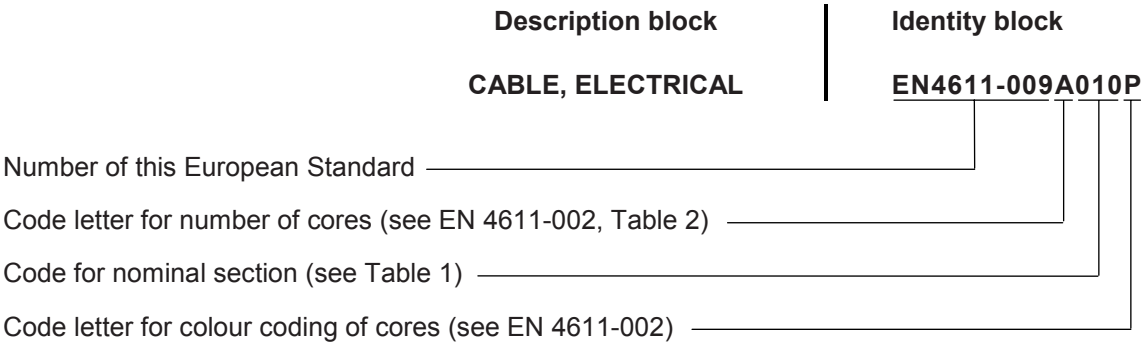
EN 3475-	Test	Details
604	Resistance to dry arc propagation	Applicable Wire damage ≤ 70 mm 75 % of collateral wires must pass the wet dielectric voltage proof test at 1,0 kV r.m.s. (EN 3475-302)
605	Wet short circuit test	Applicable
701	Strippability and adherence of insulation to the conductor	Applicable
702	Screen pushback capability	Not applicable
703	Permanence of manufacturer's marking	Applicable
704	Flexibility	Not applicable
705	Contrast measurement	Applicable Laser marking K ≥ 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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