



**SLOVENSKI STANDARD
SIST EN 2235:2009**

01-junij-2009

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Aerospace series - Single and multicore electrical cables, screened and jacketed

Luft- und Raumfahrt - Ein- und mehradrige geschirmte und ummantelte elektrische Leitungen

Série aérospatiale - Câbles électriques, mono et multiconducteurs, blindés et gainés

**STANDARD PREVIEW
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Ta slovenski standard je istoveten z: EN 2235:2006

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ICS:

49.060 Ščp \ æš Ą^• [|b \ æ Aerospace electric
^|\ dā } æ [] !^ { æš Ąã c^ { ã equipment and systems

SIST EN 2235:2009

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 2235

June 2006

ICS 49.060

English Version

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screened and jacketed**

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This European Standard was approved by CEN on 6 January 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Contents

Page

| | |
|---|----|
| Foreword..... | 3 |
| 1 Scope | 4 |
| 2 Normative references | 4 |
| 3 Terms and definitions | 4 |
| 4 Materials and construction of cables | 4 |
| 5 Required characteristics..... | 7 |
| 6 Tests methods..... | 7 |
| 7 Quality assurance | 10 |
| 8 Identification marking | 12 |
| 9 Packaging, labelling and delivery lengths | 12 |

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<https://standards.iteh.ai/catalog/standards/sist/cb43061b-1a25-4604-892a-b41ef5216687/sist-en-2235-2009>

Foreword

This European Standard (EN 2235:2006) has been prepared by the European Association of Aerospace Manufacturers - Standardization (AECMA-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 AECMA, 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 December 2006, and conflicting national standards shall be withdrawn at the latest by December 2006.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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EN 2235:2006 (E)**1 Scope**

This standard specifies the required characteristics, test methods, qualification and acceptance conditions of single and multicore cables, screened, jacketed and multicore, jacketed cables for use in aircraft electrical systems.

2 Normative references

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

ISO 2574, *Aircraft — Electrical cables — Identification marking*.

ISO 8815, *Aircraft — Electrical cables and cable harnesses — Vocabulary*.

EN 2083, *Aerospace series — Copper or copper alloy 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 3475-100*, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 100: General*.

EN 3838, *Aerospace series — Requirements and tests on user-applied markings on aircraft electrical cables*.¹⁾

EN 4434, *Aerospace series — Copper or copper alloy lightweight conductors for electrical cables — Product standard (Normal and tight tolerances)*.

EN 9133, *Aerospace series — Quality management systems — Qualification Procedure for Aerospace Standard Parts*.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8815 and EN 3475-100 apply.

4 Materials and construction of cables**4.1 General**

The individual cores shall conform to EN 2083, EN 2084 or EN 4434 and the product standards.

4.2 Materials

The materials shall conform to the product standard.

The materials used shall have no corrosive effect upon the conductors and screens and shall not be susceptible to attack by mould and other micro-organisms.

* And all parts quoted in this standard.

1) Published as AECMA Prestandard at the date of publication of this standard.

4.3 Construction of cables

4.3.1 General

The permissible operating temperature of conductors shall not be lower than the maximum operating temperature of the cable as a whole.

4.3.2 Cabled cores

The lay length of the outer lay shall not be less than eight times and not more than 16 times the nominal diameter of the cabled cores.

The core shall not be spliced.

Where filler cores are used, this shall be specified in the product standard.

4.3.3 Screened cables

4.3.3.1 General

The individual strands used for the screen shall be free from kinks, loops or breaks; their surface shall be free from corrosion and other contamination. They shall satisfy the mechanical tests in EN 3475-505 to EN 3475-508 before use.

The screen shall be in contact with all the cabled cores.

Where spiral screening is used, the lay direction shall be contrary to that of the cabled cores.

4.3.3.2 Joints

Joints in the individual strands of the screen shall be made by soldering or by laying the individual strands together over a length of at least 10 mm.

There shall be no more than one joint per 3 m cable length (measured between different individual strands).

4.3.3.3 Braid screen pushback capability

In accordance with Table 1, test 6.42.

4.3.3.4 Angle of spiral screening or braiding

The angle γ of spiral screening or braiding (as shown in Figure 1), measured against the longitudinal axis of the cable shall be at least 10°.

4.3.3.5 Screen coverage

The screen shall have a coverage β of at least 90 % for spiral screening and at least 85 % for braiding.

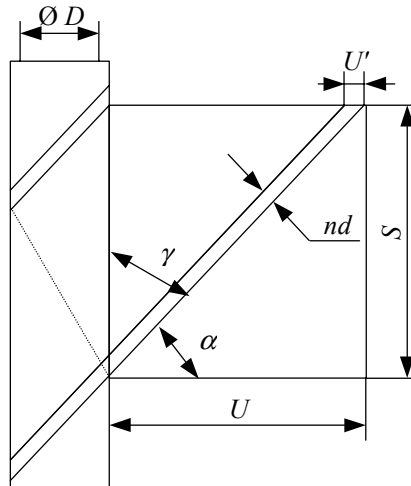


Figure 1 — Screen Coverage

The cable covering is calculated using the following formula:

— for spirals:

$$U = \pi (D + d) \quad \text{and} \quad S = \pi (D + d) \tan \alpha \quad F = U / Z / U = n d / Z / [\pi (D + d) \sin \alpha] \quad \beta = F \times 100 (\%)$$

— for braids:

$$U = \pi (D + 2d) \quad \text{and} \quad S = \pi (D + 2d) \tan \alpha$$

For braids, the filling factor F and coverage β , taking into account both braiding directions and a symmetrical braiding pattern are: $F = (U' / U) (Z / 2) = \{n d / [\pi (D + 2d) \sin \alpha]\} (Z / 2)$ and $\beta = F (2 - F) \times 100 (\%)$

where:

- S = lay length of screen in mm
- D = diameter under screen in mm (for cables with two or more cores without fillers: $D = (\pi + N) b / \pi$)
- d = diameter of screen strands in mm
- N = number of cores
- n = number of strands per carriers
- b = diameter of core in mm
- Z = total number of carriers
- F = filling factor
- β = optical coverage
- U = see Figure 1
- $U' = n d / \sin \alpha$
- γ = Strand angle
- $\alpha = \pi / 2 - \gamma$

5 Required characteristics

The characteristics of the cables, tested according to the methods described hereafter shall comply with the values given in the product standard.

6 Tests methods

See Table 1.

Table 1 — Tests, methods, application, requirements

| No. | Tests | | | | | | Requirements (and/or particulars) | |
|------|---|---------------------------------------|---|---|---|--|--|--|
| | Description | EN 3475- (and/or particulars) | Qualification ^a (See 7.1) | Each delivery | | Periodic Every 3 years (See 7.2.4) | | |
| | | | | On all cables (See 7.2.1 and 7.2.3) | Prior to delivery (See 7.2.1 and 7.2.3) | | | |
| 6 | Test conditions | 100 | X | X | X | X | | |
| 6.1 | Coverage | 3 | X | | X | | See 4.3.3.5. | |
| 6.2 | Spiral screening or braiding angle | 3 | X | | | X | See 4.3.3.4. | |
| 6.3 | Visual examination | 201 | 3 | X | | | Marking: see 8. | |
| 6.4 | Mass | 202 minimum length 0,5 m | 3 | | X | | Product standard | |
| 6.5 | Dimensions (all) outer diameter | 203 | 3 | X | X | | Product standard | |
| 6.6 | Electrical resistance per length | 301 | 3 | | X | | Product standard | |
| 6.7 | Voltage proof test: - immersion test - dry test - dry impulse test - dielectric strength of cores | 302 Alternative to dry test | 3 X X | X X | | X | 500 V a.c. 1 kV a.c. 1,5 kV a.c. peak voltage 1,5 kV a.c. | |
| 6.8 | Insulation resistance at (20 ± 2) °C: - dry test - immersion test at (95 ± 2) °C: - immersion test | 303 | 3 | | X | X X | For a length of 1 km: 1 500 MΩ 500 MΩ 15 MΩ | |
| 6.9 | Surface resistance | 304 | 3 | | | | Minimum: 1 250 MΩ.mm | |
| 6.10 | Overload resistance | 305 | Not applicable | | | | | |
| 6.11 | Continuity of conductors | 306 | 1 | X | | | | |

(continued)