



SLOVENSKI STANDARD

SIST EN 2235:2023

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Nadomešča:
SIST EN 2235:2015

Aeronautika - Eno- in večžilni električni kabli, oklopljeni in oplaščeni - Tehnična specifikacija

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

Tehnična specifikacija

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

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

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**Aerospace series - Single and multicore electrical cables,
screened and jacketed - Technical specification**

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

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

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 2235:2022) 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 document has received the approval of the National Associations and the Official Services of the member countries of ASD-STAN, 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of an identical text or by endorsement, at the latest by June 2023, and conflicting national standards shall be withdrawn at the latest by June 2023.

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EN 2235:2022 (E)

1 Scope

This document 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 2083, *Aerospace series — Copper or copper alloy conductors for electrical cables — Product standard*

EN 2084, *Aerospace series — Cables, electrical, 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 3475-201, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 201: Visual examination*

EN 3475-202, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 202: Mass*

EN 3475-203, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 203: Dimensions*

EN 3475-301, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 301: Electrical resistance per unit length*

EN 3475-302, *Aerospace series — Cable, electrical, aircraft use — Test methods — Part 302: Voltage proof test*

EN 3475-303, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 303: Insulation resistance*

EN 3475-304, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 304: Surface resistance*

EN 3475-305, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 305: Overload resistance*

EN 3475-306, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 306: Continuity of conductors*

EN 3475-307, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 307: Corona extinction voltage*

EN 3475-401, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 401: Accelerated ageing*

EN 3475-402, *Aerospace series - Cables, electrical, aircraft use - Test methods — Part 402: Shrinkage and delamination*

EN 3475-403, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 403: Delamination and blocking*

EN 3475-404, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 404: Thermal shock*

EN 3475-405, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 405: Bending at ambient temperature*

EN 3475-406, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 406: Cold bend test*

EN 3475-407, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 407: Flammability*

EN 3475-408, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 408: Fire resistance*

EN 3475-409, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 409: Air-excluded ageing*

EN 3475-410, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 410: Thermal endurance*

EN 3475-411, *Aerospace series — Cables, electrical, aircraft use - Test methods — Part 411: Resistance to fluids*

EN 3475-412, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 412: Humidity resistance*

EN 3475-413, *Aerospace series — Cable, electrical, aircraft use — Test methods — Part 413: Wrap back test*

EN 3475-414, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 414: Differential scanning calorimeter (DSC test)*

EN 3475-415, *Aerospace series — Cables, electrical, aircraft use - Test methods — Part 415: Rapid change of temperature*

EN 3475-416, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 416: Thermal stability*

EN 3475-501, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 501: Dynamic cut-through*

EN 3475-502, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 502: Notch propagation*

EN 3475-503, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 503: Scrape abrasion*

EN 3475-504, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 504: Torsion*

EN 3475-505, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 505: Tensile test on conductors and strands*

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EN 3475-506, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 506: Plating continuity*

EN 3475-507, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 507: Adherence of plating*

EN 3475-508, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 508: Plating thickness*

EN 3475-509, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 509: Solderability*

EN 3475-510, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 510: Tensile strength and elongation of extruded insulation, sheath and jacket material*

EN 3475-511, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 511: Cable-to-cable abrasion*

EN 3475-512, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 512: Flexure endurance*

EN 3475-513, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 513: Deformation resistance (Installation with plastic cable ties)*

EN 3475-601, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 601: Smoke density*

EN 3475-602, *Aerospace series — Cables, electrical, aircraft use — Test methods - Part 602: Toxicity*

EN 3475-603, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 603: Resistance to wet arc tracking*

EN 3475-604, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 604: Resistance to dry arc propagation*

EN 3475-605, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 605: Wet short circuit test*

EN 3475-701, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 701: Strippability and adherence of insulation to the conductor*

EN 3475-702, *Aerospace series — Cables, electrical, aircraft use — Test methods, Part 702: Screen pushback capability*

EN 3475-703, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 703: Permanence of manufacturer's marking*

EN 3475-704, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 704: Flexibility*

EN 3475-705, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 705: Contrast measurement*

EN 3475-706, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 706: Laser markability*

EN 3475-801, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 801: Capacitance per unit length*

EN 3475-802, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 802: Capacitance unbalance*

EN 3475-803, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 803: Capacitance variation*

EN 3475-804, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 804: Velocity of propagation*

EN 3475-805, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 805: Characteristic impedance*

EN 3475-806, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 806: Attenuation*

EN 3475-807, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 807: Transfer impedance*

EN 3475-808, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 808: Cross-talk*

EN 3475-809, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 809: Resistance unbalance*

EN 3475-810, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 810: Structural return loss*

EN 3475-811, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 811: Unbalance attenuation*

EN 3475-812, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 812: Return loss (VSWR)*

EN 3475-813, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 813: Test method to assess Power rating for coaxial cables*

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

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

ISO 2574, *Aircraft — Electrical cables — Identification marking¹*

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

¹ Published by: ISO International Organization for Standardization, <http://www.iso.ch/>.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

4 Materials and construction of cables

4.1 General

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

4.2 Materials

The materials shall conform to the product 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 nor higher than the minimum 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

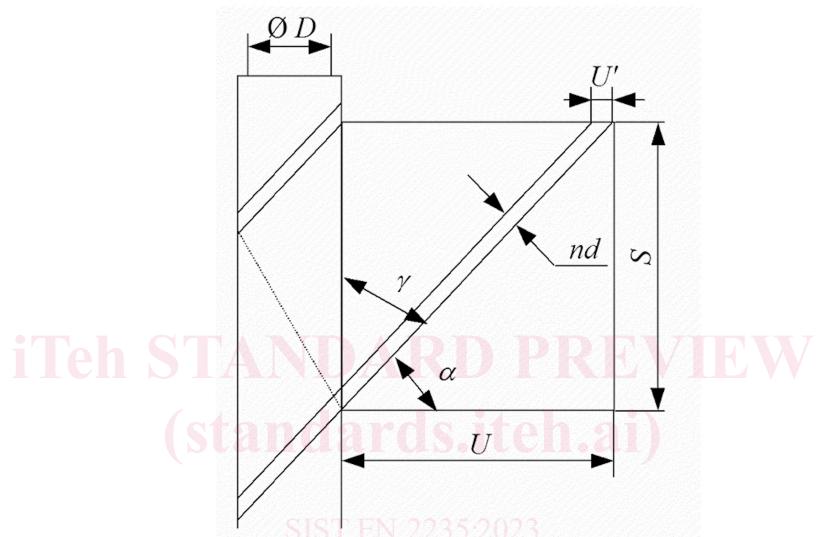
In accordance with Table 1, test 6.48.

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.



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The cable covering is calculated using the following formula:

- for spirals:

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

- for braids:

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

- for spiral screen:

the maximum length T of the non-covered area is 2 mm, and

the relative aperture (versus lay length) of the screening $100 T/L$ shall be less than 5 %.