BS EN 2084:2015

BSI Standards Publication

Aerospace series — Cables, electrical, general purpose, with conductors in copper or copper alloy — Technical specification

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 2084:2015. It supersedes BS EN 2084:2005 which is withdrawn.

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.

Published by BSI Standards Limited 2015

ISBN 978 0 580 88564 8

ICS 49.060

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2015.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 2084

September 2015

ICS 49.060

Supersedes EN 2084:2005

English Version

Aerospace series - Cables, electrical, general purpose, with conductors in copper or copper alloy - Technical specification

Série aérospatiale - Câbles, électriques, d'usage général, avec conducteurs en cuivre ou en alliage de cuivre - Spécification technique

Luft- und Raumfahrt - Elektrische Leitungen, für allgemeine Verwendung, mit Leitern aus Kupfer oder Kupferlegierung - Technische Lieferbedingungen

This European Standard was approved by CEN on 7 February 2015.

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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 2084:2015 E

Contents

Page

European foreword

This document (EN 2084:2015) 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 March 2016, and conflicting national standards shall be withdrawn at the latest by March 2016.

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.

This document supersedes EN 2084:2005.

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

1 Scope

This standard specifies the characteristics, test methods, qualification and acceptance conditions of single and multicore electric cables, without jackets, for general purpose with conductors in copper or copper alloy, intended for installation in aircraft circuits.

The insulation of these cables is designed to withstand aircraft voltages at a frequency not exceeding 2 000 Hz. Unless specified by individual product standards the maximum demonstrated ac voltage of rating of these cables is 115 V rms phase to neutral and 200 V rms phase to phase.

They are divided into types, the characteristics of which are given in the product standards. Unless otherwise specified in the product standard, the tests defined in this standard apply.

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 alloy conductors for electrical cables — Product standard*

EN 2235, *Aerospace series — Single and multicore electrical cables, screened and jacketed — Technical specification*

EN 3475-100 (all parts), *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*

EN 9102, *Aerospace series — Quality systems — First article inspection*

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

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

3 Terms, definitions and symbols

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

4 Materials and construction of cables

4.1 Conductors

They shall be conform to EN 2083 unless otherwise specified.

4.2 Finished cables

The insulation material shall present on uniform circular cross-section throughout the length of the cable.

Covering over the insulation shall be treated and applied in such a manner that the cables present a smooth appearance and are able to accept marking.

Multiconductors assembly shall be cabled according EN 2235.

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

6.1 Single core cables

See Table 1.

Table 1 — Tests: methods, application, requirements – Single core cables *(1 of 4)*

§ No.	**Tests**							**Requirements** (and/or particulars)
	Description	**EN 3475-** (and/or particulars)	Qualification [a](see 7.1).	First article (see 7.1.5)	**Each delivery**		Periodic every three years (7.2.4)	
					On all cables (7.2.1 and 7.2.2)	Prior to delivery (7.2.1 and 7.2.2)		
6	Test conditions	100	X	X	X	X	X	
6.1	Visual examination	201	3	3	X			Marking: according to Clause 8
6.2	Mass	202	3	3		X		Minimum length: 0,5 m
6.3	Dimensions (all) — outer diameter	203	3	3	 X	X		Conductor: EN 2083, unless otherwise specified. Product standard
6.4	Ohmic resistance per unit length	301	3	3		X		Product standard
6.5	Voltage proof test: — immersion test; — dry test; — or dry impulse test.	302 Alternative to dry test	 3	 3	 X X			 2,5 KV r.m.s. 5 KV r.m.s. 8 KV peak voltage
6.6	Insulation resistance — at (20 ± 2) °C; — at (95 ± 2) °C.	303	3	3			 X	For a length of 1 km: 1 500 MΩ minimum 15 MΩ minimum
6.7	Surface resistance	304	3					Minimum: 1 250 mΩ × mm
6.8	Overload resistance	305 T1 and T2: product standard	3				X	Applicable to cable of 0,6 mm^2 only
6.9	Continuity of conductors	306	1	1	X			
6.10	Corona extinction voltage	307	X	X			X	Applicable for cables rated above 200 V rms

§ No.	Tests							Requirements (and/or particulars)
	Description	**EN 3475-** (and/or particulars)	Qualification [a](see 7.1).	First article (see 7.1.5)	**Each delivery**		Periodic every three years (7.2.4)	
					On all cables (7.2.1 and 7.2.2)	Prior to delivery (7.2.1 and 7.2.2)		
6.11	Accelerated ageing	401 Mandrel diameter and test load: Table 4 Temperature: product standard	3	3			X	
6.12	Shrinkage and delamination	402 Temperature: product standard	3	3		X		Product standard
6.13	Delamination and blocking	403 Mandrel diameter: Table 4 Temperature: product standard	3	3		X		
6.14	Thermal shock	404 Temperature: product standard	3	3		X		Product standard
6.15	Bending at ambient temperature	405 Mandrel diameter: Table 4	3					
6.16	Cold bend test	406 Mandrel diameter and test load: Table 4	3	3			X	
6.17	Flammability	407	3				X	Product standard
6.18	Fire resistance	408						Not applicable
6.19	Air-excluded ageing	409 Temperature and time: product standard						Not applicable (unless specified in the product standard)
6.20	Thermal endurance	410	X					Product standard Applicable to cable of 0,6 mm^2 only
6.21	Resistance to fluids	411	1/fluid				X	Immersion test applicable to cable of 0,6 mm^2 only unless stated in the product standard
6.22	Humidity resistance	412 If method B: temperature and time: product standard	3				X	Method A or B as specified in product standard
6.23	Wrap back test	413	3	3			X	Applicable to cables ≤ 5 mm^2
6.24	Differential scanning calorimeter (DSC test)	414	X	X			X	
6.25	Rapid change of temperature	415						Not applicable
6.26	Thermal stability	416						Not applicable

§ No.	Tests							Requirements (and/or particulars)
	Description	**EN 3475-** (and/or particulars)	Qualification [a] (see 7.1).	First article (see 7.1.5)	**Each delivery**		Periodic every three years (7.2.4)	
					On all cables (7.2.1 and 7.2.2)	Prior to delivery (7.2.1 and 7.2.2)		
6.27	Fire resistance of cables confined inside a harness	417						Not applicable
6.28	Thermal endurance for conductors	418						Not applicable
6.29	Dynamic cut-through	501 (for insulation wall thickness ≤ 0,38 mm)	3	3			X	Product standard (arithmetic mean value of eight tests per specimen)
6.30	Notch propagation	502 Cut depth: product standard	3	3			X	
6.31	Scrape abrasion	503 Load: product standard	3	3			X	Product standard (requirements to be considered at 20 °C unless otherwise specified)
6.32	Torsion	504 Test load: Table 4 T3 and T4: product standard	3				X	Applicable to cables ≤ 5 mm²
6.33	Tensile test on conductors and strands	505	3			X		EN 2083 unless otherwise specified Applicable on “raw material” and on finished cable
6.34	Plating continuity	506	3			X		Applicable on “raw material” and on finished cable
6.35	Adherence of plating	507	3			X		
6.36	Plating thickness	508	3			X		EN 2083 unless otherwise specified
6.37	Solderability	509	3			X		Product standard
6.38	Tensile strength and elongation of extruded insulation, sheath and jacket material	510	3			X	X	Product standard
6.39	Cable-to-cable abrasion	511 Mass: product standard	3				X	Size 006 (20 AWG)
6.40	Flexure endurance	512 Mandrel diameter and mass: product standard	3				X	Applicable to cables ≤ 5 mm²
6.41	Deformation resistance (Installation with plastic cable ties)	513						Not applicable

§ No.	Tests							Requirements (and/or particulars)
	Description	**EN 3475-** (and/or particulars)	Qualification [a] (see 7.1).	First article (see 7.1.5)	**Each delivery**		Periodic every three years (7.2.4)	
					On all cables (7.2.1 and 7.2.2)	Prior to delivery (7.2.1 and 7.2.2)		
6.42	Porosity of copper cladding on aluminium strands	514						Not applicable
6.43	Smoke density	601	X					Product standard
6.44	Toxicity	602	X					Product standard
6.45	Resistance to wet arc tracking	603	X					Product standard
6.46	Resistance to dry arc propagation	604	X					Product standard
6.47	Wet short circuit test	605	X					Product standard
6.48	Strippability and adherence of insulation to the conductor	701	3	3		X		Adherence force minimum: Table 7
6.49	Permanence of manufacturer's marking	703	3	3		X	X	
6.50	Flexibility	704	3				X	Product standard
6.51	Permanence of user-applied marking	EN 3838	X					Product standard
	Contrast measurement	705 Laser parameters: 706	X	X		X	X	Product standard

X Test applicable single sample to be tested.

[a] Test applicable where indicated in the product standard the value defines the number of samples to be tested.

6.2 Multicore cables

See Table 2.

Table 2 — Tests: methods, application, requirements – Multicore cables

§ No.	Tests							Requirements (and/or particulars)
	Description	EN 3475- (and/or particulars)	Qualification [a] (see 7.1).	First article (see 7.1.5)	Each delivery		Periodic every three years (7.2.4)	
					On all cables (7.2.1 and 7.2.2)	Prior to delivery (7.2.1 and 7.2.2)		
6	Test conditions	100	X	X	X	X	X	Marking: according Clause 8
6.52	Visual examination	201	3	3	X			
6.53	Mass	202	3	3		X		Minimum length: 0,5 m
6.54	Dimensions (all)	203	3	3		X		Conductor: EN 2083 unless otherwise specified
	— outer diameter				X			Product standard
6.55	Ohmic resistance per unit length	301	3	3		X		Product standard
6.56	Voltage proof test:	302		3				
	— immersion test;		3					2,5 KV r.m.s.
	— dry test;				X			5 KV r.m.s.
	— or dry impulse test.	Alternative to dry test			X			8 KV peak voltage
6.57	Insulation resistance	303	3	3				For a length of 1 km:
	— at (20 ± 2) °C;							1 500 MΩ minimum
	— at (95 ± 2) °C.						X	15 MΩ minimum

X Test applicable single sample to be tested.

[a] Test applicable where indicated in the product standard the value defines the number of samples to be tested.

7 Quality assurance

7.1 Qualification

7.1.1 General requirements

See EN 9133 and EN 9102.

7.1.2 Qualification conditions

The cables shall be submitted for qualification tests on drums, spools or in coils in sufficient lengths, wound evenly and uniformly.

Each drum, spool or coil shall have a label containing information given in 9.1.

7.1.3 Qualification tests

See Table 1.

Multicore cables shall be manufactured with qualified single core cables. Multicore cables shall be tested in accordance with Table 2.

7.1.4 Extension of qualification

The qualification granted may be applicable to all the cross-sections in a group in accordance with Table 3 and Table 4 provided that the same construction, processes and materials are used.

Table 3 — Qualified cables and extension of qualification (single conductor)

Qualified cables		**Cables covered by the same qualification**	
Nominal cross-section mm²	AWG [a]	Nominal cross-section mm²	AWG [a]
0,15 or 0,25	26 or 24	0,15 to 0,25	26 to 24
0,6	20	0,4 to 1	22 to 18
2	14	1,2 to 5	16 to 10
9	8	9 to 34	8 to 2
53	0	42 to 107	1 to 0 000
a AWG: Closest American Wire Gage.			

Cables in each group shall be based upon the same design and materials.

For cross sections 9 mm² to 107 mm², different reference cross-section may be selected with agreement of the mandated body.

Table 4 — Qualified cables and extension of qualification (multiconductor)

Qualified cables [a]		**Cables covered by the same qualification**	
Number of conductors	AWG [b]	Number of conductors	AWG [b]
3	24	1 to 4	26 to 14
2	14		16 to 10
4	20		22 to 18
a Tests performed on each wire taken from the multiconductor cable under test. b AWG: Closest American Wire Gage.			

7.1.5 First article inspection tests

The first article inspection tests are to be carried out on all cable designs that were not included in the qualification demonstration. See Table 1 and Table 2.

7.2 Acceptance tests

7.2.1 Required conditions

7.2.1.1 General

See Table 1 and Table 2.

The acceptance tests shall be carried out on all cables that are to be released against this specification and its associated product standard to check that the cable characteristics are maintained.

7.2.1.2 Tests to be carried out on all cables

The cables which fail any of the tests specified in 7.2.2 shall be rejected.

7.2.1.3 Random sampling tests: retest

If any of the specimens fail one of the tests specified in 7.2.3, that test shall be repeated on another set of specimens of the same cross-section selected at random from the same batch. If one of these new specimens fails the test, the batch submitted for acceptance shall be rejected.

7.2.2 Production routine tests

The tests shall be carried out on all cables delivered.

See Table 1 and Table 2.

7.2.3 Tests prior to delivery

They shall be carried out by sampling on each production batch prior to delivery.

See Table 1 and Table 2.

7.2.4 Periodic tests

They shall be carried out by sampling every three years in accordance with Table 1 and Table 2 by sampling from cables that have been manufactured and released within the last 6 months. Samples are to be included from each of the cable groups in Table 3 and Table 4.

See Table 1 and Table 2.

8 Identification marking

Unless otherwise specified, the type, cross section and a reference for identification of country of origin, manufacturer, and the year of manufacture shall be indelibly marked on the cables, in accordance with ISO 2574.

9 Packaging, labelling and delivery lengths

9.1 Packaging and labelling

Cables supplied on drum, spools or in coils shall be wound evenly and uniformly.

All cable ends shall be easily accessible and protected where necessary.

Each drum, spool or coil shall have a label indicating:

— manufacturer's name and designation;

— cable designation according to the EN product standard;

— batch number;

— date of manufacture (month, year);

— inspector's mark;

— total length and length of each piece of cable in metres from inside to outside.

9.2 Delivery lengths

They shall be conform to Table 5 unless otherwise specified.

Table 5 — Delivery lengths

Nominal conductor cross-section mm²	**AWG** [a]	**Minimum acceptable continuous lengths**	
		for at least 85 % of cables delivered m	for not more than 15 % of cables delivered m
0,15 to 1	26 to 18	150	30
1,2 to 3	16 to 12	100	20
5	10	70	20
9 to 107	8 to 0 000	As stated in the order	

a AWG: Closest American Wire Gage.

Table 6 — Mandrel diameter and test load

Code	Nominal conductor cross-section mm^2	AWG [a]	Mandrel diameter mm	Test load N
001	0,15	26	12 times the maximum cable diameter	2,5
002	0,25	24		3,5
004	0,4	22		5
006	0,6	20		7,5
010	1,0	18		10
012	1,2	16		10
020	2,0	14		15
030	3,0	12		15
050	5,0	10		15
090	9	8	16 times the maximum cable diameter	45
140	14	6		45
220	22	4		45
340	34	2	22 times the maximum cable diameter	75
420	42	1		75
530	53	0		120
680	68	00		120
850	85	000		150
107	107	0 000		150

a AWG: Closest American Wire Gage.

Table 7 — Adherence of insulation to the conductor

Code	Nominal conductor cross-section	AWG [a]	Adhesion force minimum (N)	
	mm^2		min	max
001	0,15	26	5	120
002	0,25	24	5	120
004	0,4	22	5	120
006	0,6	20	8,5	204
010	1,0	18	12,5	175
012	1,2	16	16	224
020	2,0	14	18	252
030	3,0	12	22	308
050	5,0	10	22	308

a AWG: Closest American Wire Gage.

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™