BRITISH STANDARD

BS EN
50307:2002

Lead and lead alloys — Lead and lead alloy sheaths and sleeves of electric cables

The European Standard EN 50307:2002 has the status of a British Standard

ICS 77.150.60

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National foreword

This British Standard is the official English language version of EN 50307:2002. It supersedes BS 801:1984 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GEL/20, Electric cables, to Subcommittee GEL/20/16, Medium/high voltage electric cables, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

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EUROPEAN STANDARD **EN 50307**

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English version

Lead and lead alloys – Lead and lead alloy sheaths and sleeves of electric cables

Plomb et alliages de plomb – Gaines et manchons en plomb et alliage de plomb des câbles électriques

Blei und Bleilegierungen – Mäntel und Metallgehäuse von Kabeln aus Blei und Bleilegierungen

This European Standard was approved by CENELEC on 2002-10-01. CENELEC 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 CENELEC 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 CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 50307:2002 E

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 20, Electric cables.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50307 on 2002-10-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2003-10-01
- latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2005-10-01

Users of this European Standard should note that it covers the chemical composition of lead and lead alloy cable sheaths or sleeves after application or forming. CEN has issued a European Standard (EN 12548) to cover lead and lead alloy ingots for use in the manufacture of cable sheaths or sleeves. The compositional requirements therein apply to the material prior to manufacture of the cable sheaths or sleeves and melting loss of some of the alloying elements may occur during processing.

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, Annex A and Annex B are informative.

Contents

1 Scope

This European Standard specifies the designations, chemical compositions and other requirements for lead and lead alloy electric cable sheaths and sleeves.

2 Normative references

This European Standard incorporates by dated and undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this CENELEC Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 12548 Lead and lead alloys - Lead alloy ingots for electric cable sheathing and for sleeves

3 Definitions

For the purpose of this standard the following definitions apply.

3.1
electric cable sheath
uniform and continuous tubular metallic covering, generally extruded and generally of a circular cross section, encasing one or more insulated electrical conductors in order to contain an impregnant if present, mechanically protect the insulation, to prevent the ingress of moisture and to act as an electrical screen

3.2
sleeve
short length of sheath which may be used in the jointing of some types of electric cables

4 Designation

Lead and lead alloys to this standard are designated by an alphanumeric system, see Table 1.

The first letter P signifies lead and lead alloys, the second letter K signifies cables. The three numbers indicate a specific and unique composition for cable sheaths and sleeves, the third letter S signifies sheath (or sleeve).

5 Ordering information for sheaths and sleeves

In order to facilitate the enquiry, order and confirmation of order procedures between the purchaser and supplier for the supply of lead and lead alloy cable sheaths or sleeves, the purchaser shall state on the enquiry and order the following information:

a) the denomination (e.g. sheath or sleeves);
b) the number of this European Standard;
c) the material designation (see Table 1);

d) whether chemical analysis tests are required;

e) whether a certificate of analysis tests or a declaration of conformity is required (see Clause 11);

f) whether some form of identifier is required for sleeves (see Clause 11);

g) in the case of sleeves, the number, length and dimensions.

NOTE The tolerances on length, and other dimensions are to be agreed between the purchaser and the supplier at the time of enquiry or ordering.

6 Requirements

6.1 Chemical composition of sheaths and sleeves

The chemical composition of the sheaths or sleeves shall conform to the requirements given in Table 1.

6.2 Freedom from defects

The sheaths and sleeves shall be free of any defects, damage or contamination liable to adversely affect their intended purpose or service life.

7 Sampling

Sampling of sheaths or sleeves for chemical analysis shall be in accordance with the requirements of the product specification.

8 Analysis methods

When analysis is carried out to verify conformity of sheaths and sleeves to this standard the analytical methods used shall be at the discretion of the supplier.

In cases of dispute concerning the results of analysis and pending the publication of a suitable European Standard containing analytical methods (in preparation by CEN), the methods of analysis shall be agreed between the disputing parties.

For expression of the results of chemical analysis the rounding rules given in Clause 10 shall be used.

9 Re-test procedure

Should any sample fail to meet the specified requirements in 6.1, two further samples shall be taken from the same sheath or batch of sleeves and subjected to the same test or tests in which the original sample failed. Should both additional test samples pass the test, all the cables or sleeves in the batch from which they were taken shall be regarded as complying with the requirements of this specification. Should either of them fail, the batch from which the samples were representative shall be regarded as failing to comply. Further re-sampling and testing shall be subject to agreement between the supplier and customer.

10 Rounding of analysis results

For the purposes of determining conformity to the compositional requirements of this standard, an observed or a calculated value obtained during analysis shall be rounded in accordance with the following procedure. It shall be rounded in one step to the same number of figures used to express the specified limit in Table 1.

The following rules shall be used for rounding:

a) if the figure immediately after the last figure to be retained is less than five, the last figure to be retained shall be kept unchanged;

b) if the figure immediately after the last figure to be retained is equal to or greater than five, the last figure to be retained shall be increased by one.

11 Inspection documentation for electric cable sheathing and sleeves

If requested by the purchaser at the time of ordering, the supplier shall provide inspection documents with each consignment of cables or sleeves. The documentation shall be as chosen by the purchaser and shall be in accordance with either a) or b) as follows:

a) a **certificate of analysis**, giving the results obtained on the specific batches in the consignment. This certificate shall also include the following information:

   1) name and address of supplier;

   2) date of certificate of analysis;

   3) name and address of purchaser;

   4) purchaser’s contract, or order, number;

   5) a description of the goods and the quantity supplied;

   6) details of the specification and alloy designation of the sheathing supplied;

   7) signature of suppliers authorised representative.

b) a **declaration of conformity** of the consignment with the order requirements. This declaration shall include the following information:

   1) name and address of supplier;

   2) date of declaration of conformity;

   3) name and address of purchaser;

   4) purchaser’s contract, or order, number;

   5) a description of the goods and the quantity supplied;

   6) details of the specification and alloy designation of the sheathing supplied; and

7) the following declaration:

The goods detailed hereon have been manufactured to conform to the requirements of the purchaser's order and to the description, quantity and specification detailed thereon.

Signed:
(Supplier's authorised representative)

12 Marking and labelling of sheathing and sleeves

12.1 Cable sheathing

The identification of electric cable sheathing is not a requirement of this specification but shall be in accordance with the requirements of the product standard.

12.2 Sleeves

If requested at the time of enquiry or order, the sleeves shall be identified in a manner agreed between the supplier and the purchaser. The identification shall provide the following minimum information:

a) the manufacturer's name, trade or identification mark;
b) the number and year of this European Standard : EN 50307:2002;
c) the material designation.

Table 1 - Chemical composition of lead and lead alloys in electric cable sheaths and sleeves

Compositions in % (m/m)

Alloy designation [a]	Element	Alloying elements									Impurities									
		As	Bi	Ca	Cd	Cu	Sb	Sn	Te	Pb	Ag	As	Bi	Cd	Cu	Ni	Sb	Sn	Te	Zn
PK900S	min.	-	-	-	-	-	-	-	-	99,90	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	-	-	-	-	-	0,008	0,005	0,06	0,005	0,005	0,002	0,003	0,02	0,002	0,001
PK001S	min.	-	-	-	-	-	0,80	-	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	-	0,95	-	-		0,005	0,005	0,05	0,001	0,003	0,001	-	0,01	0,002	0,0005
PK002S	min.	-	-	-	-	-	0,50	-	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	-	0,60	-	-		0,005	0,005	0,05	0,001	0,003	0,001	-	0,005	0,002	0,0005
PK008S *	min.	-	-	-	-	-	0,45	-	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	-	0,55	-	-		0,003	0,003	0,02	0,001	0,003	0,001	-	0,003	0,002	0,001
PK009S *	min.	-	-	-	-	-	0,5	-	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	-	1,0	-	-		0,003	0,001	0,05	-	0,005	-	-	0,005	-	0,001
PK011S	min.	-	-	-	0,14	-	-	0,35	-	Rem	-	-	-		-	-	-	-	-	-
	max.	-	-	-	0,16	-	-	0,45	-		0,0025	0,001	0,015		0,003	0,0005	0,003	-	0,002	0,0005
PK012S	min.	-	-	-	0,06	-	-	0,17	-	Rem	-	-	-		-	-	-	-	-	-
	max.	-	-	-	0,09	-	-	0,23	-		0,0025	0,001	0,015		0,003	0,0005	0,003	-	0,002	0,0005
PK021S	min.	-	-	-	-	-	0,15	0,35	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	-	0,25	0,45	-		0,005	0,001	0,03	0,001	0,003	0,001	-	-	0,002	0,0005
PK022S	min.	-	-	-	-	-	0,06	0,35	-	Rem	-	-	-	-	-	-	-	-	-	-
	max..	-	-	-	-	-	0,10	0,45	-		0,005	0,001	0,03	0,001	0,003	0,001	-	-	0,002	0,0005
PK023S	min.	-	-	-	-	-	0,08	0,17	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	-	0,12	0,23	-		0,005	0,001	0,03	0,001	0,003	0,001	-	-	0,002	0,0005
PK031S	min.	0,15	0,08	-	-	-	-	0,10	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	0,18	0,12	-	-	-	-	0,13	-		0,0025	-	-	0,0005	0,003	0,0005	0,003	-	0,002	0,0005
PK032S	min.	0,07	0,04	-	-	-	-	0,05	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	0,09	0,06	-	-	-	-	0,07	-		0,0025	-	-	0,0005	0,003	0,0005	0,003	-	0,002	0,0005
PK041S	min.	-	-	-	-	0,030	-	-	0,035	Rem	-	-	-	-	-	-	-	-	-	-
	max..	-	-	-	-	0,045	-	-	0,045		0,005	0,001	0,03	0,001	-	0,0010	0,001	0,02	-	0,0005
PK042S	min.	-	-	-	-	0,014	-	-	0,014	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	0,020	-	-	0,020		0,0025	0,001	0,015	0,001	-	0,0005	0,001	0,02	-	0,0005
PK043S	min.	-	-	-	-	0,006	-	-	0,006	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	0,009	-	-	0,009		0,0025	0,001	0,015	0,001	-	0,0005	0,001	0,02	-	0,0005
PK049S *	min.	-	-	-	-	0,03	-	-	0,035	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	0,045	-	-	0,045		0,003	0,001	0,05	-	-	-	0,001	0,005	-	0,001

Table 1 - Chemical composition of lead and lead alloys in electric cable sheaths and sleeves (concluded)

Compositions in % (m/m)

Alloy designation [a]	Element	Alloying elements									Impurities									
		As	Bi	Ca	Cd	Cu	Sb	Sn	Te	Pb	Ag	As	Bi	Cd	Cu	Ni	Sb	Sn	Te	Zn
PK051S	min.	-	-	0,02	-	-	-	0,30	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	0,04	-	-	-	0,40	-		0,0025	0,001	0,015	0,001	0,001	0,0005	0,001	-	0,002	0,0005
PK061S	min.	-	-	-	-	0,03	-	-	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	0,05	-	-	-		0,005	0,001	0,03	0,001	-	0,001	0,001	0,02	0,002	0,0005
PK069S *	min.	-	-	-	-	0,03	-	-	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	0,05	-	-	-		0,003	0,001	0,05	-	-	-	0,001	0,005	-	0,001
PK071S	min.	-	-	-	-	-	-	-	0,035	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	-	-	-	0,045		0,005	0,001	0,03	0,001	0,003	0,001	0,001	0,02	-	0,0005
PK079S *	min.	-	-	-	-	-	-	-	0,035	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	-	-	-	0,045		0,003	0,001	0,05	-	0,001	-	0,001	0,005	-	0,001
PK081S	min.	-	-	-	-	0,03	0,5	-	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	0,05	1,0	-	-		0,003	0,001	0,05	-	-	-	-	0,005	-	0,001
PK089S *	min.	-	-	-	-	0,03	0,5	-	-	Rem	-	-	-	-	-	-	-	-	-	-
	max.	-	-	-	-	0,05	1,0	-	-		0,005	0,001	0,05	0,001	0,001	0,001	0,001	0,005	0,002	0,0005

NOTE 1 The permitted maximum for any element (or elements) not listed in Table 1 that could affect the application and which could be present in lead, may be subject to agreement between the purchaser and the supplier.

NOTE 2 If sodium is used for deoxidisation purposes, the maximum residual sodium content should be agreed between the manufacturer and the purchaser.

NOTE 3 A dash (-) in any column indicates that a limit is not individually specified for an element in that particular grade.

[a] Where the numerical part of the alloy designation (e.g. 031) is identical to an ingot designation in EN 12548, the cable sheathing or sleeving would normally be manufactured from the corresponding ingot. Those alloys for which there is no corresponding ingot in EN 12548 are indicated by an asterisk (*).

Annex A
(informative)

Cross-references between alloy designations

Table A.1 gives information relating to the alloy designations used in this European Standard to the designations previously used in a number of countries for the nearest related alloys.

Table A.1

Alloy designation in this European Standard	Designation previously used for the nearest related alloy
PK900S	Unalloyed lead
PK001S	B
PK002S	½B
PK008S	PbSb0,5
PK009S	PbSb0,5
PK011S	C
PK012S	½C
PK021S	E
PK022S	EL
PK023S	½E
PK031S	F3
PK032S	½F3
PK041S	Cu-Te
PK042S	½ Cu-Te
PK043S	¼ Cu-Te
PK049S	PbTeCu
PK051S	Pb-Ca-Sn
PK061S	Pb-Cu
PK069S	PbCu
PK071S	Pb-Te
PK079S	PbTe
PK081S	PbSb0,5Cu
PK089S	Pb-Cu-Sb (new)

Annex B
(informative)

Use of lead and lead alloys for cable applications

The choice or recommendation of a cable sheath alloy for a particular application is based on a number of factors including experience and knowledge of the alloy's characteristics, the design and method of cable construction, manufacturing processes available, transportation, storage, installation and jointing techniques. Other factors which could influence the choice would be the degree of support provided to the cable when installed, service conditions, environment and number of years service that the cable could reasonably be expected to survive given the known service conditions.

At the time of preparation this European Standard the lead alloys listed in Table B.1 are known to have been satisfactorily used for specific cable sheath applications.

The listing in Table B.2 is indicative of the functional performance of the lead alloys, especially in relation to vibrational conditions.

The order in which the lead alloys are listed is not intended to indicate any order of preference. The absence of an alloy in a particular cable application or functional performance category does not exclude other possibilities.

Lead alloys used for cable sleeves shall be at the discretion of the supplier/installer but must be suitable for their intended application.

Table B.1 - End-use application - Installation type

Cable application	Lead alloys used				
Power:					
Land based, pressure assisted	PK011S PK031S PK061S	PK012S PK041S PK069S	PK021S PK042S PK081S	PK022S PK043S PK089S	PK023S PK049S
Land based, non pressure assisted	PK900S PK021S PK042S PK079S	PK008S PK022S PK043S	PK009S PK023S PK049S	PK011S PK031S PK051S	PK012S PK041S PK071S
Submarine, pressure assisted	PK012S PK041S	PK021S PK042S	PK022S PK043S	PK023S PK049S	PK031S
Submarine, non pressure assisted	PK008S PK031S PK071S	PK012S PK041S PK079S	PK021S PK042S	PK022S PK043S	PK023S PK049S
Telecommunication:					
Land based buried	PK002S	PK012S	PK021S	PK051S	
Land based suspended	PK001S	PK021S			
Land based submarine	PK012S	PK021S	PK023S		

Table B.2 - End-use application - Functional requirements

1 **Application, functional requirements**	2 **Alloy designation in this European Standard**	3 **Designation previously used for the nearest related alloy**
Normal degree of vibration - armoured cables	PK900S	Unalloyed lead
	PK009S	PbSb0,5
	PK012S	½ C
	PK023S	½ E
	PK031S	F3
	PK032S	½ F3
	PK041S	Cu-Te
	PK042S	½ Cu-Te
	PK043S	¼ Cu-Te
	PK061S	Pb-Cu
	PK069S	PbCu
	PK081S	PbSb0,5Cu
	PK089S	Pb-Cu-Sb (new)
Long and strong vibration - unarmoured cables	PK002S	½ B
	PK008S	PbSb0,5
	PK011S	C
	PK021S	E
	PK022S	EL
	PK041S	Cu-Te
	PK042S	½ Cu-Te
	PK043S	¼ Cu-Te
	PK049S	PbTeCu
	PK051S	Pb-Ca-Sn
	PK071S	Pb-Te
	PK079S	PbTe
Abnormal degree of vibration - unarmoured cables	PK001S	B

blank

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