

---

---

**Komunikacijski kabli – 2-1. del: Splošna pravila za načrtovanje in konstrukcijo**

Communication cables - Part 2-1: Common design rules and construction

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 50290-2-1:2005](https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b03/sist-en-50290-2-1-2005)

<https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b03/sist-en-50290-2-1-2005>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 50290-2-1:2005

<https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b03/sist-en-50290-2-1-2005>

EUROPEAN STANDARD

**EN 50290-2-1**

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2005

ICS 33.120.10

English version

## **Communication cables**

### **Part 2-1: Common design rules and construction**

Câbles de communication  
Partie 2-1: Règles de conception  
communes et construction

Kommunikationskabel  
Teil 2-1: Allgemeine Entwurf-  
und Konstruktionsregeln

## **iTeh STANDARD PREVIEW**

This European Standard was approved by CENELEC on 2004-10-01. 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.

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

# **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**

## Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 46X, Communication cables.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50290-2-1 on 2004-10-01.

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) 2005-10-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2007-10-01

This European Standard has been prepared under the European Mandate M/212 given to CENELEC by the European Commission and the European Free Trade Association.

---

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 50290-2-1:2005](https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b03/sist-en-50290-2-1-2005)

<https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b03/sist-en-50290-2-1-2005>

## Contents

<b>Introduction .....</b>	<b>5</b>
<b>1 Scope.....</b>	<b>6</b>
<b>2 Normative references.....</b>	<b>6</b>
<b>3 Definitions.....</b>	<b>6</b>
<b>4 Common design rules.....</b>	<b>6</b>
4.1 Materials.....	6
4.1.1 Conductor materials.....	6
4.1.2 Optical fibres.....	8
4.1.3 Taping / fillers.....	8
4.1.4 Insulating and sheathing materials.....	8
4.1.5 Messenger wires.....	8
4.1.6 Armour.....	9
4.2 Cable make-up.....	10
4.2.1 General design.....	10
4.2.2 Sheathing.....	10
4.2.3 Marking.....	10
<b>5 Register of symbols used.....</b>	<b>11</b>
<b>6 Material constants.....</b>	<b>13</b>
6.1 Table of material constants relating to dielectric and sheath and their values for different materials.....	13
6.2 Tables of material constants relating to conductors.....	14
6.3 Construction constants.....	15
6.3.1 Table of construction constants relating to inner conductor.....	15
6.3.2 Table of construction constants relating to braided outer conductors and screens.....	15
6.4 Braid wire dimensions.....	15
6.5 Attenuation factors.....	16
6.6 Maximum permissible input power/ current carrying capacity.....	16
6.6.1 Coaxial cables.....	16
6.6.2 Balanced cables.....	18
<b>7 Standard values of characteristic impedance and outer diameter of dielectric for coaxial cables .....</b>	<b>18</b>
7.1 Impedance of coaxial cables.....	18
7.2 Nominal diameters over dielectric of coaxial cables.....	18
<b>8 Coaxial cable construction details .....</b>	<b>20</b>
8.1 General.....	20
8.2 Inner conductor.....	20
8.3 Stranded inner conductor.....	20
8.4 Braided outer conductor.....	21
8.5 Medium between outer conductor and screen.....	21
8.6 Braided screen.....	21
8.7 Sheath.....	22
8.8 Attenuation.....	22
8.9 Nominal characteristic impedance $z_0$ and capacitance $c_2$ per unit length.....	23
<b>9 Standard values of characteristic impedance and outer diameter of dielectric for symmetrical cables.....</b>	<b>23</b>
9.1 Impedance of symmetrical cables.....	23
<b>10 Symmetrical cable construction details .....</b>	<b>24</b>
10.1 Attenuation.....	25

<b>11</b>	<b>Common characteristics .....</b>	<b>25</b>
11.1	Weight calculation .....	25
<b>12</b>	<b>Calculation of electrical properties .....</b>	<b>26</b>
12.1	DC resistance of conductors and screen, per unit length .....	26
12.2	Permissible voltages .....	26
12.2.1	Test voltage, dielectric, $u_t$ .....	26
12.2.2	Discharge test voltage, dielectric, $u_d$ .....	27
12.2.3	Test voltage, sheath .....	27

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN 50290-2-1:2005](https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b03/sist-en-50290-2-1-2005)

<https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b03/sist-en-50290-2-1-2005>

## Introduction

EN 50290-2-1 series gives directly or by reference all common requirements for communication cables.

It is completed by generic, sectional, family and detail specifications, as appropriate, to describe in a detailed manner each type of cables with its specific characteristics.

EN 50290, which is the basic reference standard for communication cables, consists of the following parts:

- Part 1-1 General
- Part 1-2 Definitions
- Part 2-1 Common design rules and construction
- Part 2-1X Materials
- Part 3 Quality assessment
- Part 4-1 Environmental conditions and safety aspects
- Part 4-2 Guide for use

The test methods are described in the basic reference standard EN 50289 - Communication cables - Specifications for test methods, which consists of the following parts:

- Part 1-X Electrical test methods
- Part 2-X Transmission and optical test methods
- Part 3-X Mechanical test methods
- Part 4-X Environmental test methods

## 1 Scope

This European Standard harmonises the standardisation of symmetrical, coaxial and optical cables used for the infrastructure of communication, multimedia and control networks. Most of the cables covered by this European Standard are primarily intended to be used in IT networks. However, they can also be used for other applications with the exception of those which presume a direct connection to the mains electricity supply.

EN 50290-2-1 gives the common rules for the design and construction of symmetrical, coaxial and optical cables used for the infrastructure of communication and control networks.

It is to be used in conjunction with EN 50290-1-1 and is completed by generic, sectional, family and detail specifications, as appropriate, to describe in a detailed manner each type of cable with its specific characteristics.

## 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.

EN 50290-1-2	Communication cables - Part 1-2: Definitions
EN 50290-2-23	Part 2-23: Materials - PE insulation
EN 50290-2-24	Part 2-24: Materials - PE sheathing
EN 50290-2-25	Part 2-25: Materials - Polypropylene insulation compounds
EN 50290-2-26	Part 2-26: Materials - Halogen free flame retardant insulation compounds
EN 50290-2-27	Part 2-27: Materials - Halogen free flame retardant thermoplastic sheathing compounds
IEC 60304	Standard colours for insulation for low-frequency cables and wires
IEC 60028	International standard of resistance for copper
IEC 60793-1	Optical fibres - Part 1: Generic specification.

## 3 Definitions

For the purpose of this standard, the definitions given in EN 50290-1-2 apply.

## 4 Common design rules

### 4.1 Materials

#### 4.1.1 Conductor materials

##### 4.1.1.1 Wires and inner conductors

The construction and material of wires or inner conductor shall be specified in the relevant specification.



The conductor shall be either solid or stranded annealed copper. The conductivity of the copper shall be in accordance with IEC 60028.

Alternatively, the conductor shall consist of copper-clad steel. The layer of copper cladding shall be continuous, and shall adhere to the steel; the cross-section shall be circular, such that the maximum resistance of the clad conductor shall not exceed that given for copper conductor, in accordance with IEC 60028, by more than a factor of 4,8, 3,5 and 2,8, respectively, for 21 % (minimum), 30 %, and 40 % nominal conductivity grade copper-clad steel. The percentage elongation at break, when tested in accordance with test methods given in 9.7 shall be not less than 1 %. The minimum tensile strength shall be 827 N/mm<sup>2</sup>, 792 N/mm<sup>2</sup>, 760 N/mm<sup>2</sup> for 21 %, 30 %, and 40 % grade, respectively.

Alternatively, the conductor shall consist of copper clad aluminium. The layer of copper cladding shall be continuous, and shall adhere to the aluminium, the cross section shall be circular, such that the maximum resistance of the clad conductor shall not exceed that given for copper conductor, in accordance with IEC 60028, by more than a factor of 1.8. The percentage elongation at break, when tested in accordance with test methods given in 9.6 shall not be less than 1 %.

Conductor joints made after the last drawing operation are not allowed.

The stranded conductor shall consist of wires circular in section and assembled, without insulation between them, by concentric stranding or bunching.

The individual wires of the solid or stranded conductor may be plain or metal-coated.

#### 4.1.1.2 Outer conductor or screen

STANDARD PREVIEW

(standard.it.ch.a)

The construction and material of the outer conductor and/or screen shall be specified in the detail specification.

The outer conductor or screen may be [SIST EN 50290-2-1:2005](https://standards.itec.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b03/sist-en-50290-2-1-2005)

- a) a single or double braid of plain or metal coated annealed copper wire. Joints in the braiding wires shall be soldered, twisted or woven-in and there shall be no joint in the complete braid. The braid shall be evenly applied. The braid angle and the filling factor shall be specified in the detail specification,
- b) a copper or aluminium tape formed round the core as a continuous and closed screen with a sufficient overlap bonded or not bonded as specified in the detail specification,
- c) a high permeability alloy tape, helically wound with overlap,
- d) a gas-tight tube of copper or aluminium material (i.e. extruded, welded smooth or corrugated),
- e) a layer of metal foil or metallised film applied with a sufficient overlap bonded or not bonded, covered with a copper braid as in item a) above. When the metal foil or the film is in copper, the braid shall be in copper. When the metal foil or the film is in aluminium, the braid shall be in aluminium or tinned copper. The braid shall always be in contact with metal,
- f) a screen as described in d) with two layers of bi-directional helically wound wires instead of braid,
- g) any combination of these.

#### 4.1.2 Optical fibres

Optical fibres shall be uniform in quality and their characteristics shall meet the requirements of IEC 60793-2-XX.

#### 4.1.3 Taping / Fillers

Tapes and/or fillers may be used to achieve a circular cross section of the cable, and/or to prevent moisture ingress and/or to achieve the required electrical, mechanical and environmental performance. They usually consist of plastic, fibreglass, aromatic polyamide, or swellable material depending upon the intended use.

The relevant specification shall give details of the taping and fillers to be used.

#### 4.1.4 Insulating and sheathing materials

The insulation and outer sheath of the cable shall be of a suitable material as specified in the relevant cable specification.

It may be solid, cellular, or composite (e.g. foam skin, plastic/metal composite).

Unless otherwise specified, plastic materials for sheath and insulation shall comply with the relevant part of EN 50290-2-XX.

The insulation and sheath shall have appropriate mechanical characteristics before and after ageing within the temperature limits to which it may be exposed to normal use.

#### 4.1.5 Messenger wires

##### 4.1.5.1 Design

[SIST EN 50290-2-1:2005](https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b07/sist-en-50290-2-1-2005)

[https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-](https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b07/sist-en-50290-2-1-2005)

[d221916b0b07/sist-en-50290-2-1-2005](https://standards.iteh.ai/catalog/standards/sist/59a02821-ca08-4c05-b9b6-d221916b0b07/sist-en-50290-2-1-2005)

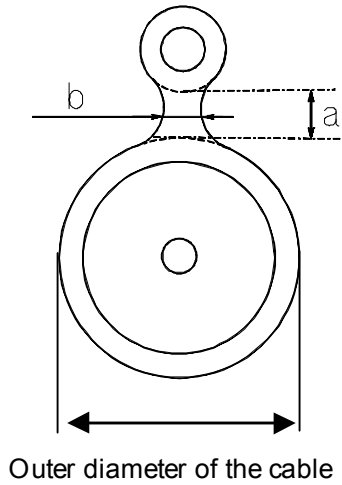
This standard specifies requirements for aerial messenger wires.

Messenger wires shall consist of either a strand (wires twisted together with a uniform lay) or a single wire. Messenger wire may consist of metallic or non-metallic materials.

In case of metallic material, the material used shall consist of either aluminium alloy or steel which may be galvanised. Interstices between the stranded wires may be bituminised as an available option.

Unless otherwise specified in the relevant detail specification, wires in the outer layer of strands shall have a left-hand lay (S strand) and in case of strands with more than seven wires, the lay direction shall alternate for each successive layer.

In the case of a Figure 8-shaped design as shown below, unless otherwise specified in the detail specification, the height (a) and the thickness (b) of the web should be in accordance with Table 1.



**Table 1**

Web dimension in mm			
(a)		(b)	
Min.	Max.	Min.	Max.
3	5	2	4

**4.1.5.2 Information to be supplied**

The following information shall be given in the relevant detail specification.

- strand and wire diameter mm;
- cross section mm<sup>2</sup>;
- nominal overall messenger diameter and tolerances mm;
- approximate mass kg/km;
- breaking load kN;
- effective modulus of elasticity kN/ mm<sup>2</sup>;
- coefficient of linear expansion 1/°C.
- wire material

**4.1.6 Armour**

Where additional tensile strength or protection from external damage is required, armouring shall be provided.

Examples of armour include:

- steel tapes;
- steel wires;
- re-inforced glass fibre;
- corrugated steel;
- aramid yarns;
- and any combination of them.

The relevant cable specification shall give details of the armour construction and materials to be used.