SLOVENSKI STANDARD
SIST EN 50290-4-2:2015

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Komunikacijski kabli - 4-2. del: Splošno o uporabi kablov - Vodilo za uporabo

Communication cables - Part 4-2: General considerations for the use of cables - Guide to use

Kommunikationskabel - Teil 4-2: Allgemeine Betrachtungen für die Anwendung der Kabel - Leitfaden für die Verwendung

Câbles de communication - Partie 4-2: Considérations générales pour l'utilisation des câbles - Guide d'utilisation

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ICS:

33.120.10	Koaksialni kabli. Valovodi	Coaxial cables. Waveguides

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Kommunikationskabel - Teil 4-2: Allgemeine Betrachtungen für die Anwendung der Kabel - Leitfaden für die Verwendung

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Contents

Foreword

This document (EN 50290-4-2:2014) has been prepared by CLC/TC 46X "Communication cables".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-06-05
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2016-09-16

This document supersedes EN 50290-4-2:2008.

EN 50290-4-2:2014 includes the following significant technical change with respect to EN 50290-4-2:2008:

– Subclause 5.3 was revised.

This standard should be read 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.

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

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

EN 50290-4, *Communication cables — General considerations for the use of cables*, is divided into the following sub-parts:

– *Part 4-1: Environmental conditions and safety aspects*;

– *Part 4-2: Guide to use* [the present document].

1 Scope

The scope of this European Standard is to help installers and cabling designers to understand the range of communication metallic cables available. To help this choice the fundamental and practical rules on how to use these cables are established.

The related cables are specified in the documents issued by CLC/TC 46X and its sub-committees.

These cables are:

- telecom cables used in access network,
- data communication twisted pairs cables,
- coaxial cables used in CATV.

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 50083 (all parts), *Cable networks for television signals, sound signals and interactive services*

EN 50090 (all parts), *Home and Building Electronic Systems (HBES)*

EN 50117 (all parts), *Coaxial cables*

EN 50173 (all parts), *Information technology — Generic cabling systems*

EN 50174 (all parts), *Information technology — Cabling installation*

EN 50200, *Method of test for resistance to fire of unprotected small cables for use in emergency circuits*

EN 50288 (all parts), *Multi-element metallic cables used in analogue and digital communication and control*

EN 50289-1-3, *Communication cables — Specifications for test methods — Part 1-3: Electrical test methods — Dielectric strength*

EN 50289-3-9, *Communication cables — Specifications for test methods — Part 3-9: Mechanical test methods — Bending tests*

EN 50289-4-16, *Communication cables — Specifications for test methods — Part 4-16: Environmental test methods — Circuit integrity under fire conditions*

EN 50290 (all parts), *Communication cables*

EN 50406 (all parts), *End user multi-pair cables used in high bit rate telecommunication networks*

EN 50407 (all parts), *Multi-pair cables used in high bit rate digital access telecommunication networks*

EN 50441 (all parts), *Cables for indoor residential telecommunication installations*

EN 50575, *Power, control and communication cables — Cables for general applications in construction works subject to reaction to fire requirements*

3 Communication cable basics

Communication cables are the highways and arteries that provide a path for telecommunications devices. There is a general tendency to say that one transmission medium is better than another. In fact, each transmission medium has its place in the design of any communication system. Each has characteristics that will make it the ideal medium to use based on a particular set of circumstances. It is important to recognize the advantages of each and develop a system accordingly.

Factors to consider when choosing communication cable include:

– efficiency of transmission,

– cost,

– ease of installation and maintenance,

– availability.

4 Types of cables

4.1 General

When working with communication cables, an installer will deal with two basic types:

– balanced,

– unbalanced.

Balanced cabling involve twisted-pair and/or twinaxial twisted cables that are composed of one or more pairs of copper wires (see Figure 1).

Unbalanced cabling involves coaxial cable, that has only one centre conductor of either solid or stranded inner conductor and an outer concentric conductor. Most data and voice networks use twisted-pair cabling. Coaxial cable is now used primarily for CATV, satellite and video connections (see Figure 2).

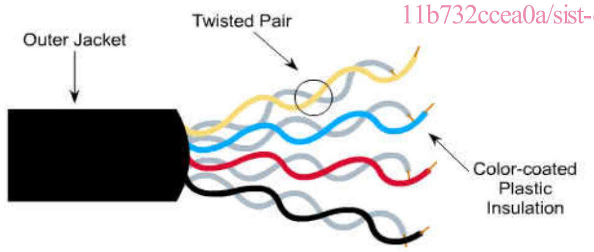

Figure 1 — Balanced cabling

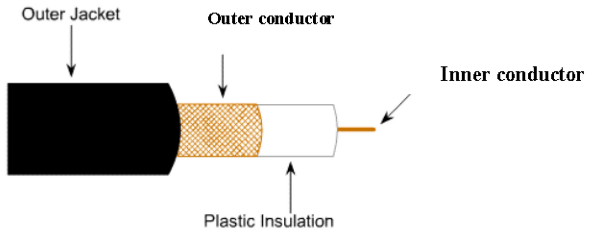

Figure 2 — Unbalanced cabling

4.2 Twisted pairs cables

4.2.1 Pair construction

There are two different pairing constructions:

– a pair made of two insulated wires twisted together (wire A and B in Figure 4);

– a quad made of four insulated wires twisted together, providing two pairs from a star formation (first pair wire A and B and second pair wire D and C in Figure 3);

– a pair made of two insulated wires twisted together;

– a quad made of four insulated wires twisted together, providing two pairs.

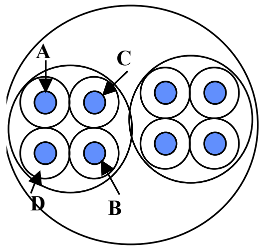

Figure 3 — Starquads

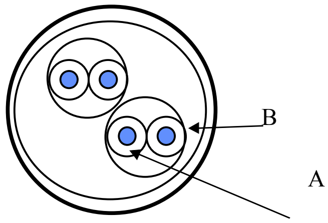

Figure 4 — Pairs

4.2.2 Pair counts

Telecommunications cable comes in many sizes, starting with a single pair of wires, up to and perhaps more than 4 200 pairs of wires. These pairs may be arranged in concentric layers or in bundles. A data communication terminal is fed normally with a maximum of 4 pairs, so the last part of the network is built with cables having 1 to 4 pairs. As the other parts of the network aggregate several terminal cables, they have a larger number of pairs. The highest number of pairs is encountered at the main communication switch. The main communication switch is then connected to global systems by satellite, fibre, radio, waveguide and coaxial (CATV).

The identification of each pair in the cable is made through an appropriate colour code that is given in the relevant standard or may be agreed between customer and manufacturer (see Example in Figure 5).

Figure 5 — Example of pair arrangement in a telecommunication cable

4.3 Coaxial cable (unbalanced)

Coaxial cable is called ‘coaxial’ because it includes one conductor surrounded by a layer of insulation, itself surrounded by a concentric conductor (a metallic foil or braid or a combination of both) and an outer sheath (see Figure 6).

Coaxial cable is the primary type of communication cable used by cable TV companies for signal distribution between the community antenna (CATV, normally 75 Ω) and user’s homes and businesses. The WWW is now accessible through such communication mediums making possible all types of connections. It was once the primary medium for Ethernet and other types of local area networks because of its ability to transmit high frequencies. With the development of standards for Ethernet over twisted-pair, new installations of coaxial cable for this purpose have all but disappeared.

Coaxial cable is still used for connecting CCTV cameras to monitors, antenna's and video switches. Cables for radio communication (mobile telephone) antenna's are also coaxial, these are feeder cables and are normally 50 Ω.

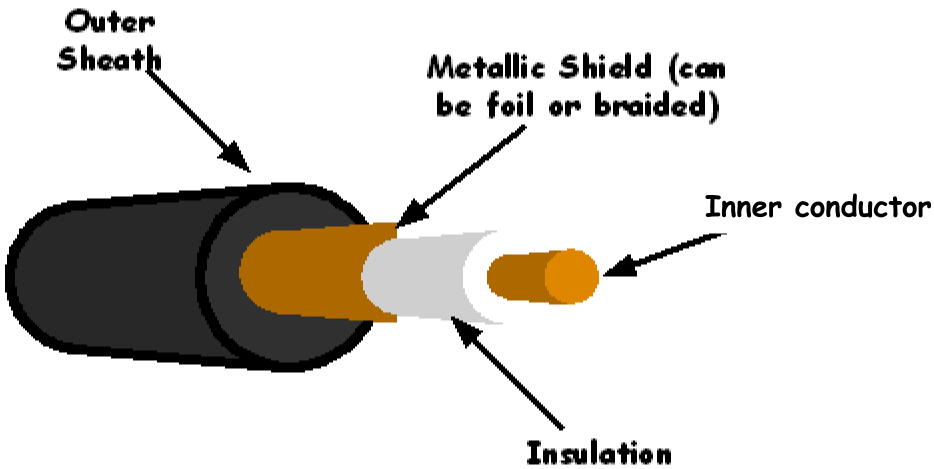

Figure 6 — Coaxial cable illustration

There are several variations. Triaxial (Triax) is a form of cable that uses a single centre conductor with two shields (one could be tape and one braid). This is important when considering EMC (electromagnetic compatibility). This composition affords a greater transmission distance with less loss due to interference from outside electrical signals. Twinaxial (Twinax) is two coaxial systems packaged within a single concentric outer conductor and jacket to form the cable.

4.4 Flexible cables versus rigid cables

Communication infrastructure includes different sections. Some sections are installed, indoor or outdoor, permanently (i.e. fixed) so the cables are static (once installed, do not move) for their lifetime. Some other sections are subjected to continuous movement and different mechanical behaviour is required for the cable (see 7.6).

Copper is inherently rigid and leads to build cables with a certain degree of stiffness suitable for permanent installations. However, copper is one of the most malleable of the rigid metals and so cannot be unsupported. Nonetheless, cable construction includes design to allow appropriate bending radius to be performed without degradation of mechanical and transmission properties.

For some applications there is a need for smaller bending radius, multiple bending, or less stiffness while keeping requested transmission properties (i.e. work area cables or cables used in lift machinery). Specific designs to achieve this target use stranded conductors instead of one-solid-conductor; also with insulation material having specific mechanical properties are used. These cables, named "flexible cables", are often used in cord assemblies and are specified for a given number of mechanical cycles.

In order to provide more flexibility to cables used in cords, stranded conductors are used instead of solid conductors. Not only does this improve flexibility but also allows the cable to be repeatedly flexed many times; this can be useful in robotic systems.

The relevant cable standards identifies whether the cable is either flexible or rigid, depending on how the cable will be used in its life cycle i.e. look for properties such as simulated installation, torsion and twisting or flexing performance tests.

These basic principles, along with avoiding already known stresses and misuses of installations, will ensure the cable does not irreversibly degrade below the performance criteria. There are many situations already known that will change the performance criteria below that of the specified limits.

5 Cables and regulations

5.1 General

In addition to functional requirements cables have to meet the essential requirements of European Directives like the LVD (Low Voltage Directive) and the CPD (Construction Products Directive) and may have to contribute to the compliance of systems versus other directives like the EMCD (Electromagnetic Compatibility Directive).

EN 50290-4-1 gives the relationship between cables and main European Directives by detailing the related cable characteristics and associated tests.

5.2 Low voltage

Cables that are described into the documents issued by CLC/TC 46X and its sub-committees are tested for voltage withstanding.

The test is performed between conductors and between the conductors or screen and the outer surface of the sheath.

When constructed in accordance with EN 50290-2-1 and submitted to spark testing, communication cables may be installed together with Low Voltage cable.

Moreover the tests are performed after environmental and ageing tests. In addition the raw materials of these cables are defined in the EN 50290 series. This ensures sufficient stability of the cable related to this characteristic for its life cycle.

Thus these cables are considered safe when:

– they are used for their intended purpose and applications;

– they are used under voltages and currents that do not exceed the limits given in the relevant specification.

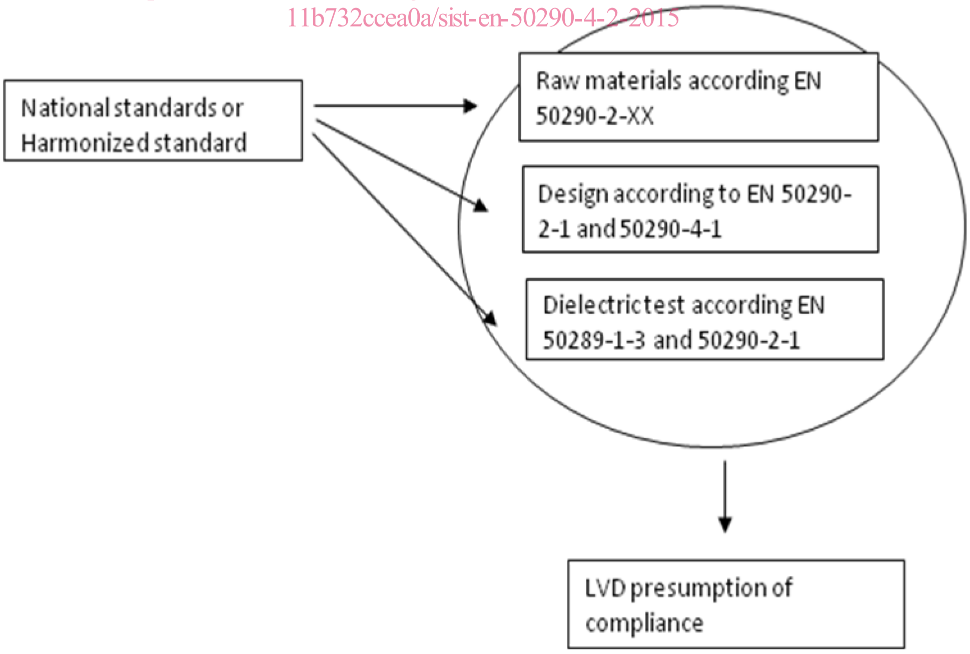

Figure 7

5.3 Fire reactions and Euroclasses

Cables that are installed in construction works are governed by the “Construction Product Regulation”; thus they shall be “CE” marked according to EN 50575.

Moreover, in each country, regulations may exist that explain the use of cables according to a given Euroclass versus the type of building that is considered.

Regulations as well as standards give only the minimum requirement and it is therefore always recommended to choose cable that fulfill or better exceed these requirements. This is particularly true when the requirement is safety related.

The designer/installer is invited to consider the relevant regulation related to safety in case of fire. A choice of cables that strictly comply to the requirements will give greater safety margin (especially in the case where the public or individuals are involved).

The EN 50288, EN 50441 and EN 50117 product standards series refer to the EN 50290 series to describe how a cable behaves in fire. This is achieved through EN 50290-4-1 that gives the relationship between the Euroclasses and the related test methods and limits.

Some local regulations/customer-requirements are stricter than the Euroclassification tables and therefore can and should be designed by discussions between the producer and customer.

During a building fire, a cable that runs in a wall, up an elevator shaft, or through an air-handling plenum could become a wick that carries the flame from one floor, or one part of the building, to the next. The standards, among other things, enable engineers to calculate the time that it will take for a cable to become a hazard once it is exposed. Evacuation times and building safety management can now be engineered to ensure complete safety for the occupants.

Additionally, because the outer coverings of cables and wires are typically plastic, they can create smoke when they burn. They also describe the amount of smoke and the type of gasses a burning cable can generate. This is important because cables often run in ventilation system return spaces above ceilings or below floors.

5.4 Electromagnetic behaviour

5.4.1 General

A cable's path may pass through many stray electric fields. Some of these may come from motors used in heating, ventilation, and air conditioning (HVAC). Florescent lights, radio transmitters, and power transformers may generate others. These stray fields are called ‘electromagnetic interference’ (EMI) if they originate from electrical sources and ‘radio frequency interference’ (RFI) if they come from radios, mobile phones, radars, or microwave ovens.

There are electrical environments in which EMI and RFI are so strong that induced voltage in the cable affects the integrity of the transmitted signals thus additional shielding is a requirement to make communication possible. An expensive way to supply this shielding might be to route the cabling through small pipes, called conduit, and then to make sure that the conduits are grounded (to make sure that any stray fields picked up by the conduits are passed to ground and do not induce interference into the data cables). However, conduit is expensive and difficult to work with.

5.4.2 Coaxial cables

The EN 50117 series that describes coaxial cables defines two classes of shielding effectiveness. The EN 50117 series that describes coaxial cables defines multiple classes of shielding effectiveness. The most commonly used, Class A, implies the use of a “foil+braid” outer conductor that would provide a sufficient immunity to the cable. The use of Class A cables gives assurance that the cabling system will work satisfactorily under normal conditions. Other shielding methods such as foil-braid-foil or foil-braid-foil-braid may also be used and higher shielding classifications may also be considered.

5.4.3 Twisted pairs cables

The coupling attenuation and/or the transfer impedance that is given in the relevant cable specification describe electromagnetic behaviour of twisted pairs cables. The coupling attenuation is the resultant of twist effect and screening effect.

The actual signal on the twisted pair version is applied to both the ‘a’ leg and ‘b’ leg simultaneously. However, the actual signal voltage level in each leg is opposite, 180’ out of phase, and therefore any emissions are naturally cancelled. The result is that in twisted-pairs, interference such as EMI and RFI tends to be cancelled out when the signal is reconstituted in a comparator.

On an other hand, keeping the cable twisted means that both of the wires in the pair are likely to be affected equally by the interference.

Installers shall preserve the twist of the pairs in these cables when mating the connectors to avoid introducing performance-degrading problems. When the immunity provided by the twist is not sufficient, it is better to use cable that carries its own screening when extra shielding is needed.

Two kinds of extra shielding may be provided:

– the first is an overall foiled screen (FTP) – (F/UTP);

– the second involves individually screened pairs within a cable with (SFTP) – (SF/UTP), (SSTP) or without (STP) an overall screen.

EN 50174-2 describes well the mechanisms of each of the kind of twisted pair cables.

A short summary for governing the choice of cables twisted pairs telecom cables would be:

– use unscreened cables whenever it is possible;

– use unscreened pairs cable with overall screen (FTP) if you cannot control the electromagnetic environment or to preserve your cable to be influenced by the installation conditions;

– use multiple screens cables (individually screened pairs SFTP or SSTP or specific cables) in case of harsh environment and when it is required by the transmission performances.

There are reasons why STP/FTP are not employed everywhere:

- The shielding layers shall be properly grounded in order to minimize signal degradation. If there is a difference in ground potential at different parts of the network, perhaps because problems exist with the ground system, or different areas are fed from different power sources, the shields will conduct these ground differences. These currents are called ground loops. Ground loops can become sources of interference, and they can even become shock hazards.

- STP is less flexible than UTP because of the shielding and is more difficult to install.

As a rule of thumb that applies to any telecommunication cable, one may consider that the use of a closed metallic continuous pathway (EN 50174-2) is roughly equivalent to a cable screen that gives 20 dB screening effectiveness.