
**Road vehicles — Automotive cables —
Part 11:
Dimensions and requirements for
coaxial RF cables with a specified
analogue bandwidth up to 6 GHz (20
GHz)**

Véhicules routiers — Câbles automobiles —

*Partie 11: Dimensions et exigences des câbles RF coaxiaux de bande
passante analogique spécifiée jusqu'à 6 GHz (20 GHz)*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 32, *Electrical and electronic components and general system aspects*.

A list of all parts in the ISO 19642 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document has been added to existing standards in the ISO 19642 series. It was prepared following a joint resolution to improve the general structure of the ISO automotive electric cable standards. This new structure adds more clarity and, by defining a new standard family, opens up the standard for future amendments.

Many other standards currently refer to ISO 6722-1, ISO 6722-2 and ISO 14572. Therefore, these standards will stay valid at least until the next scheduled systematic review and will be replaced later on by the ISO 19642 series.

For new automotive cable projects customers and suppliers are advised on using the ISO 19642 series.

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Road vehicles — Automotive cables —

Part 11:

Dimensions and requirements for coaxial RF cables with a specified analogue bandwidth up to 6 GHz (20 GHz)

WARNING — The use of this document may involve hazardous materials, operations, and equipment. This document does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate safety practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This document specifies the dimensions and requirements for coaxial radio frequency (RF) cables with a specified analogue bandwidth up to 6 GHz (for special cases up to 20 GHz) intended for use in road vehicle applications where the nominal system voltage is 30 V a.c. or 60 V d.c.

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.

ISO 19642-1, *Road vehicles — Automotive cables — Terminology and design guidelines*

ISO 19642-2:—¹⁾, *Road vehicles — Automotive cables — Test methods*

IEC 62153-4-3, *Metallic communication cable test methods — Part 4-3: Electromagnetic compatibility (EMC) - Surface transfer impedance — Triaxial method*

IEC 62153-4-4, *Metallic communication cable test methods — Part 4-4: Electromagnetic compatibility (EMC) — Test method for measuring of the screening attenuation as up to and above 3 GHz, triaxial method*

ASTM B452, *Standard Specification for Copper-Clad Steel Wire for Electronic Application*

ASTM B105, *Standard Specification for Hard-Drawn Copper Alloy Wires for Electric Conductors*

CEN/TS 13388, *Copper and copper alloys — Compendium of compositions and products*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 19642-1 apply.

ISO and IEC maintain terminology 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/>

1) Second edition under preparation. Stage at the time of publication: ISO/PRF 19642-2:2023.

4 Specifications

4.1 General test conditions

The test conditions given in ISO 19642-2:—²⁾, 4.1 shall apply. The descriptions of the tests are found in ISO 19642-2. This document only contains requirements and specific remarks. The cables shall be submitted to the tests as specified in [Clause 7](#).

If the supplier and the customer agree upon modifications or changes to the methods and requirements, it is required that all the changes and modifications are clearly documented.

NOTE The clause numbers in this document are aligned with the clause numbers in ISO 19642-2. Test clause numbers not needed in this document are identified as “Test is not required” or “Test is not possible”.

4.2 Voltage rating

The voltage rating is established by the rating of the cores 30 V a.c. or 60 V d.c.

4.3 Temperature classes

The temperature class rating is established by the rating(s) of the core and sheath. The rating of the cable shall be equal to the lowest rating of the core and sheath. For details on temperature classes, see ISO 19642-1.

4.4 Cable construction

For detailed information on preferred constructions, see [Tables 12 to 15](#).

Other constructions and materials are permissible when agreed between customer and supplier.

4.5 Safety concerns

See the “Warning” at the beginning of this document.

4.5.1 Core

4.5.1.1 Conductor

4.5.1.1.1 Conductor material

For preferred conductor materials see ISO 19642-3:2019, Table 1. Additional materials such as copper clad steel (CCS) shall be according to ASTM B452 and copper alloys shall be according to ASTM B105 or CEN/TS 13888.

4.5.1.1.2 Conductor construction

For preferred conductors of the core, see ISO 19642-3. Conductor materials as well as other conductors may be used as agreed between the customer and the supplier.

4.5.1.1.3 Conductor diameter

For construction requirements of preferred cable types please refer to [Tables 12 to 15](#).

2) Second edition under preparation. Stage at the time of publication: ISO/DIS 19642-2:2023.

4.5.2 Dielectric core

4.5.2.1 Insulation material

The insulation material shall be documented.

4.5.2.2 Dielectric core outside diameter

Please refer to [Tables 12](#) to [15](#).

4.5.3 Screen

4.5.3.1 Screen construction

The screen shall consist of at least one metallic braid. Additionally, the use of metal foils, single or double-sided metal layered polymer foils is allowed. The metal foil shall be between the dielectric and the braid. A metallic side of the foil shall be in electrical contact to the braid. For construction requirements of cable types please refer to [Tables 12](#) to [15](#).

4.5.3.2 Diameter under sheath

For construction requirements of cable types please refer to [Tables 12](#) to [15](#).

4.5.4 Sheath

4.5.4.1 Sheath material

The sheath material shall be documented.

4.5.4.2 Sheath thickness

For construction requirements of preferred cable types please refer to [Tables 12](#) to [15](#).

4.5.4.3 Outside cable diameter

For construction requirements of preferred cable types please refer to [Tables 12](#) to [15](#).

4.6 Cable designation

The cable designation is established or determined using the fields according to [Table 1](#). The entries follow the example.

EXAMPLE CX174a.

Table 1 — Cable designator fields

CX	for coaxial cable
174	an up to 3-digit reference number to identify similar cable types
a	a lower-case version designator to differentiate between similar constructions

For cable designators of preferred cable types refer to [Tables 12](#) to [15](#).

4.7 Testing of representative cable constructions

When a test is required in [Clause 7](#), all cable constructions shall meet the requirements. However, if testing of representative cable constructions is permitted by agreement between customer and supplier, conformity for a cable family may be demonstrated by testing samples of selected cable types only.

Conformity of a cable family made of the same insulation and sheath compound may be demonstrated by testing the sample of the cable family with the smallest sheath wall thickness only. Resistance to flame propagation [6.5.14](#) shall be performed on all sheathed finished cables. RF testing according to [Table 10](#) is required for all members of the cable family.

4.8 Reference and requirements for the tests according ISO 19642-2

All tests are defined in ISO 19642-2. This document only contains requirements and specific remarks.

4.9 General remark on requirements

Requirements are specified in [Tables 12](#) to [15](#) for the preferred coaxial RF cable types. The requirements for other coaxial RF cable types shall be as agreed between customer and supplier.

5 Requirements for the conductor and dielectric

5.1 General

The conductor and dielectric shall fulfil the requirements per the tests as specified in [Table 8](#) according to its temperature class rating.

The details of the usage of "If required" tests shall be as agreed between customer and supplier. Both have to define:

- 1) if the test has to be performed;
- 2) if the test has to be performed for gathering data without a limit;
- 3) a mandatory limit.

Numbers and titles in this clause are aligned with the tests defined in ISO 19642-2 giving an implicit reference. Tests not required for this document are identified as "Test is not required" or "Test is not possible".

5.2 Dimensional tests

5.2.1 Dielectric core outside diameter

No single value shall be outside the specified values in [Tables 12](#) to [15](#).

5.2.2 Insulation thickness

Test is not required.

5.2.3 Conductor diameter

No single value shall be outside the specified values [Tables 12](#) to [15](#).

5.2.4 Cross sectional area

Test is not required.

5.2.5 In-process dielectric outside diameter

In-process dielectric outside diameter monitoring is mandatory. No single value shall be outside the specified values in [Tables 12](#) to [15](#).

5.3 Electrical tests

5.3.1 Conductor resistance

No single value shall be outside the specified values in [Tables 12](#) to [15](#).

5.3.2 Determination of temperature coefficients

Test is not required.

5.3.3 Withstand voltage

Test is not required.

5.3.4 Withstand voltage after environmental testing

5.3.4.1 Test voltage

The test voltage is 1 kV a.c., hold for 1 min.

5.3.4.2 Requirement

Breakdown shall not occur.

5.3.5 Insulation faults

5.3.5.1 Test voltage

The test voltage is 1 kV a.c.

5.3.5.2 Requirement

Breakdown shall not occur.

5.3.6 Insulation volume resistivity

The usage of this test shall be as agreed between customer and supplier. In this case the value shall be $\geq 1 \times 10^9 \Omega \times \text{mm}$.

5.4 Mechanical tests

5.4.1 Strip force (A) of dielectric

The usage of this test shall be as agreed between customer and supplier. In this case measure the strip force between inner conductor and dielectric cable insulation. The measured force shall be within the values as agreed between customer and supplier.

5.4.2 Abrasion test

Test is not required.

5.4.3 Breaking force of the finished cable

Test is not required.

5.4.4 Cyclic bending test

Test is not required.

5.4.5 Flexibility test

Test is not required.

5.5 Environmental tests

5.5.1 Test specimen preparation and winding tests

Test does not apply.

5.5.2 Long term heat ageing, 3 000 h, at temperature class rating

Test is not required.

5.5.3 Short term heat ageing, 240 h at temperature class rating + 25 °C

Test is not required.

5.5.4 Thermal overload, 6 h at temperature class rating + 50 °C

Test is not required.

5.5.5 Pressure test at high temperature

Test is not required.

5.5.6 Shrinkage by heat

The maximum shrinkage shall not exceed 2 mm from either end.

5.5.7 Low temperature winding

Test is not required.

5.5.8 Cold impact

Test is not required.

5.5.9 Temperature and humidity cycling

Test is not required.

5.5.10 Resistance to hot water

Test is not required.

5.5.11 Resistance to liquid chemicals

Test is not required.

5.5.12 Durability of cable marking

Test is not required.

5.5.13 Stress cracking resistance

This test is to be performed for cables with insulation materials that are prone to environmental stress cracking problems (e.g. FEP and ETFE) by agreement between customer and supplier. After the test no conductor shall be visible. During 5.3.4 breakdown shall not occur.

5.5.14 Resistance to ozone

Test is not required.

5.5.15 Resistance to flame propagation

Test is not required.

6 Requirements for the screened and sheathed coaxial RF cable

6.1 General

The finished cable shall be submitted to the tests as specified in [Table 9](#) and [Table 10](#).

Numbers and titles in this clause are aligned with the tests defined in ISO 19642-2 giving an implicit reference. Tests not required for this part are intentionally omitted in this document.

The details of the usage of "If required" tests shall be as agreed between customer and supplier. Both shall define:

- 1) if the test shall be performed;
- 2) if the test shall be performed for gathering data without a limit;
- 3) a mandatory limit.

6.2 Dimensional tests

6.2.1 Cable outside and inner layer diameters

Measure the following parameters:

- dielectric core outside diameter;
- diameter under sheath;
- outside cable diameter.

No single value shall be outside the specified values in [Tables 12](#) to [15](#).

6.2.2 Ovality of sheath

The usage of this test shall be as agreed between customer and supplier. In this case the value of ovality shall be < 10 % measured immediately after extrusion.

NOTE Sheath ovality can be different after handling due to mechanical deformation.

6.2.3 Thickness of sheath

No single value shall be outside the specified values in [Tables 12](#) to [15](#).