INTERNATIONAL STANDARD

ISO 19642-12

First edition
2023-05

Road vehicles — Automotive cables —

Part 12: Dimensions and requirements for unscreened twisted pair RF cables with a specified analogue bandwidth up to 1 GHz

Véhicules routiers — Câbles automobiles —

Partie 12: Dimensions et exigences pour les câbles RF en paire torsadée non blindés de bande passante analogique spécifiée jusqu'à 1 GHz

Reference number
ISO 19642-12:2023(E)

© ISO 2023



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

© ISO 2023 – All rights reserved

Contents

Page

Foreword ... **vi**
Introduction ... **vii**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Specifications ... **1**
4.1 General test conditions ... 1
4.2 Safety concerns ... 2
4.3 Voltage rating ... 2
4.4 Temperature classes ... 2
4.5 Cable construction ... 2
4.5.1 Single Cores ... 2
4.5.2 Twisted pair ... 3
4.5.3 Separator ... 3
4.5.4 Sheath ... 3
4.6 Cable designators ... 3
4.7 Representative cable elements testing ... 4
4.8 Reference and requirements for the tests ... 4
4.9 General remark on requirements ... 4
5 Requirements for the cable's dielectric cores ... **4**
5.1 General ... 4
5.2 Dimensional tests ... 4
5.2.1 Cable outside diameter ... 4
5.2.2 Insulation thickness ... 5
5.2.3 Conductor diameter ... 5
5.2.4 Cross sectional area (CSA) ... 5
5.2.5 In-process cable outside diameter ... 5
5.3 Electrical tests ... 5
5.3.1 Conductor resistance ... 5
5.3.2 Determination of temperature coefficients ... 5
5.3.3 Withstand voltage ... 5
5.3.4 Withstand voltage after environmental testing ... 5
5.3.5 Insulation faults ... 5
5.3.6 Insulation volume resistivity ... 6
5.4 Mechanical tests ... 6
5.4.1 Strip force ... 6
5.4.2 Abrasion ... 6
5.4.3 Breaking force of the finished cable ... 6
5.4.4 Cyclic bending ... 6
5.4.5 Flexibility ... 6
5.5 Environmental tests ... 6
5.5.1 Test specimen preparation and winding tests ... 6
5.5.2 Long term heat ageing, 3 000 h, at temperature class rating ... 6
5.5.3 Short term heat ageing, 240 h at temperature class rating +25 K ... 6
5.5.4 Thermal overload, 6 h at temperature class rating + 50 K ... 6
5.5.5 Pressure test at high temperature ... 6
5.5.6 Shrinkage by heat ... 6
5.5.7 Low temperature winding ... 7
5.5.8 Cold impact ... 7
5.5.9 Temperature and humidity cycling ... 7
5.5.10 Resistance to hot water ... 7
5.5.11 Resistance to liquid chemicals ... 7

© ISO 2023 – All rights reserved

5.5.12 Durability of cable marking ... 7
5.5.13 Stress cracking resistance ... 7
5.5.14 Resistance to ozone ... 7
5.5.15 Resistance to flame propagation ... 7

6 Requirements for the finished UTP or JUTP cables ... 7
6.1 General ... 7
6.2 Dimensional tests ... 7
6.2.1 Cable outside diameter for JUTP cables ... 7
6.2.2 Ovality of sheath for JUTP cables ... 8
6.2.3 Thickness of sheath for JUTP cables ... 8
6.2.4 In-process cable outside diameter for JUTP cables ... 8
6.2.5 Lay length ... 8
6.3 Electrical tests ... 8
6.3.1 Electrical continuity ... 8
6.3.2 Withstand voltage at final inspection ... 8
6.3.3 Screening effectiveness ... 8
6.3.4 Sheath fault on screened cables ... 8
6.3.5 General information on electrical test setups of unscreened balanced cables ... 8
6.3.6 General information on low frequency electrical tests ... 8
6.3.7 Resistance unbalance ... 8
6.3.8 Capacitance ... 9
6.3.9 Inductance ... 9
6.3.10 General information on radio frequency (RF) electrical tests ... 9
6.3.11 Velocity of propagation ... 9
6.3.12 Characteristic impedance in frequency domain (CIF) ... 10
6.3.13 Characteristic impedance in time domain (CIT) ... 10
6.3.14 Insertion loss, IL ... 10
6.3.15 Return loss, RL ... 10
6.3.16 Unbalance attenuations ... 10
6.4 Mechanical tests ... 10
6.4.1 Strip force of sheath ... 10
6.4.2 Cyclic bending ... 11
6.4.3 Flexibility ... 11
6.4.4 Cyclic bending test for RF cables ... 11
6.4.5 Dynamic bending tests for RF cables ... 11
6.4.6 Test for assessment of minimum bending radius ... 11
6.4.7 Strip force of screen ... 11
6.4.8 Abrasion test of sheath ... 11
6.5 Environmental tests ... 11
6.5.1 Test specimen preparation and winding tests ... 11
6.5.2 Long term heat ageing, 3 000 h at temperature class rating ... 11
6.5.3 Short term heat ageing, 240 h at temperature class rating + 25 °C ... 12
6.5.4 Thermal overload, 6 h at temperature class rating + 50 °C ... 12
6.5.5 Pressure test at high temperature ... 12
6.5.6 Shrinkage by heat of sheath ... 12
6.5.7 Low temperature winding ... 12
6.5.8 Cold impact ... 12
6.5.9 Temperature and humidity cycling ... 12
6.5.10 Resistance to liquid chemicals ... 12
6.5.11 Durability of sheath marking ... 12
6.5.12 Resistance to ozone ... 12
6.5.13 Artificial weathering ... 13
6.5.14 Resistance to flame propagation ... 13

7 Test overview tables ... 13
7.1 Test table for single cores ... 13
7.2 Test tables for finished cables ... 14

8 Cable types ... 17

© ISO 2023 – All rights reserved

8.1 Cable parameters 17
8.2 Application requirements 19
8.2.1 CAN 19
8.2.2 CAN FD 19
8.2.3 FlexRay 19
8.2.4 100BASE-T1 Ethernet 21
8.2.5 1000BASE-T1 Ethernet 25
Annex A (normative) **Colour combinations** **29**
Bibliography **30**

© ISO 2023 – All rights reserved

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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

© ISO 2023 – All rights reserved

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.

© ISO 2023 – All rights reserved

Road vehicles — Automotive cables —

Part 12: Dimensions and requirements for unscreened twisted pair RF cables with a specified analogue bandwidth up to 1 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 unscreened single twisted pair RF cables with a specified analogue bandwidth up to 1 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 — Part 1: Terminology and design guidelines*

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

ISO 19642-3, *Road vehicles — Automotive cables — Part 3: Dimensions and requirements for 30 V a.c. or 60 V d.c. single core copper conductor cables*

ISO 21111-8:2022, *Road vehicles — In-vehicle Ethernet — Part 8: Electrical 100-Mbit/s Ethernet transmission media, components and tests*

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/

4 Specifications

4.1 General test conditions

The test conditions of ISO 19642-2 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.

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

© ISO 2023 – All rights reserved