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Second edition
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Road vehicles — Automotive cables —

Part 1: Vocabulary and design guidelines

Véhicules routiers — Câbles automobiles —

Partie 1: Vocabulaire et lignes directrices pour la conception

Reference number
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Foreword

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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*.

This second edition cancels and replaces the first edition (ISO 19642-1:2019), which has been technically revised.

The main changes are as follows:

— new parts have been added to the ISO 19642 series (ISO 19642-11 and ISO 19642-12);

— reflecting these additions ISO 19642-2 had to be amended;

— some new terms and definitions for screened RF cables have been added for a new standard of the ISO 19642 series;

— Annex C has been added to give informative advice on how to address and manage requalification of cables already released against the older ISO standards ISO 6722-1 and ISO 6722-2.

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 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. These standards will stay valid at least until the next scheduled systematic review and will be replaced later by the ISO 19642 series.

For new automotive cable projects, customers and suppliers are advised to use the ISO 19642 series.

This document defines general terms used in cable engineering to lay a solid foundation for discussions and written information transfer in this field.

Annex A informally defines a calculation method for many important cable parameters (e.g. resistance limits, several cable dimension).

Annex B informally proposes preferred colour concentrations for automotive cables.

Annex C gives an expert opinion on how to address and manage requalification of single core cables already released against the old, but still active, ISO standards ISO 6722-1 and ISO 6722-2.

Road vehicles — Automotive cables —

Part 1:
Vocabulary and design guidelines

1 Scope

This document defines terms in the field of cables applied in road vehicle general purpose applications, for use in the other parts of the ISO 19642 series.

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 19642-7, *Road vehicles — Automotive cables — Part 7: Dimensions and requirements for 30 V a.c. or 60 V d.c. round, sheathed, screened or unscreened multi or single core copper conductor cables*

ISO 19642-8, *Road vehicles — Automotive cables — Part 8: Dimensions and requirements for 30 V a.c. or 60 V d.c. round, sheathed, screened or unscreened multi or single core aluminium conductor cables*

3 Terms and definitions

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/

3.1 Terms related to voltage rating

3.1.1
AC voltage
voltage in an alternating current circuit that also periodically reverses because the current has a periodic function of time

Note 1 to entry: Whenever AC voltage is specified in the ISO 19642 series, the AC root mean square (r.m.s.) value shall be used.

3.1.2
60 V cable
cable (3.3.7) intended for use in road vehicle applications where the *nominal system voltage* (3.1.6) is less than or equal to 30 V a.c. or 60 V d.c.

3.1.3
900 V cable
cable (3.3.7) intended for use in road vehicle applications where the *nominal system voltage* (3.1.6) is less than or equal to 600 V a.c. or 900 V d.c.

3.1.4
1 500 V cable
cable (3.3.7) intended for use in road vehicle applications where the *nominal system voltage* (3.1.6) is less than or equal to 1 000 V a.c. or 1 500 V d.c.

3.1.5
DC voltage
non-alternating constant or pulsed voltage

3.1.6
nominal system voltage
maximum continuous voltage of a *conductor* (3.3.13) to its system ground under normal conditions

3.2 Terms related to temperatures

3.2.1
temperature class rating
temperature range for safe operation of the *cable* (3.3.7) divided into eight temperature classes as defined in Table 1

Table 1 — Temperature class rating

Class	Is equivalent to Class	Temperature °C
A	T 1	−40 to 85
B	T 2	−40 to 100
C	T 3	−40 to 125
D	T 4	−40 to 150
E	T 5	−40 to 175
F	T 6	−40 to 200
G	T 7	−40 to 225
H	T 8	−40 to 250

3.2.2
room temperature
RT
situation with a temperature of (23 ± 3) °C and a relative humidity (RH) of 45 % to 75 %

3.3 Terms related to cables

3.3.1
bare conductor
metal *cable* (3.3.7) *conductor* (3.3.13) in which the strand or strands are not coated

3.3.2
bedding layer
non-metallic covering applied (normally extruded) around the assembly of the *cores* (3.3.14) (and *fillers* (3.3.18), if any) of a *multi-core cable* (3.3.29) to obtain a more circular outline

3.3.3
braid
covering formed from bare or plated metallic or non-metallic material

3.3.4
braid parameter
parameter of a *braid* (3.3.3) as defined in Table 2

Table 2 — Braid parameter formulae

Diameter over braid	Number of single strands in one direction	Angle of lay perpendicular to cable axis
$D_B = D_C + 4 \times D_S$	$n_d = n_S \times \frac{n_C}{2}$	$\theta = \arctan \frac{2 \times L_L}{\pi \times (D_B + D_C)}$
Coverage [2)]	Optical coverage, braid percentage	Lay length
$B = \frac{n_d \times D_S}{L_L \times \cos(\theta)} \quad B < 1$ $1 \quad B \geq 1$	$B_o = (2 \times B - B^2) \times 100$	$L_L = 25{,}4 \times \frac{n_S}{2 \times P}$

Key to braid parameters

D_S diameter of single strand, in mm

D_C diameter of core below the braid, in mm

D_B diameter over braid, in mm

n_S number of strands in one carrier

n_d number of single strands in one direction

n_c number of carriers

L_L lay length, in mm

θ angle of lay perpendicular to cable axis, in degrees

P picks per inch (number of braid crossover points in 1" = 25,4 mm)

B coverage, proportion of the covered surface by strands in one direction compared to the whole surface

B_o optical coverage, also called braid percentage; proportion of the covered surface by strands in both directions compared to the whole surface, in percentage

Note 1 to entry: For better accuracy the angle θ shall not be measured directly but be calculated from the measured dimensional parameters referenced in the formulae above.

Note 2 to entry: A value of $B > 1$ is physically impossible so, if due to measurement tolerances, a value of $B > 1$ is obtained, it shall be adjusted to 1.

Note 3 to entry: A braid is formed by a number of single strands which are grouped into carriers and applied to the *cable* (3.3.7) surface in two different directions (left and right or S and Z) in a form that each carrier of one direction is alternatively above and below the adjacent carrier of the other direction.

Note 4 to entry: See Figure 1.

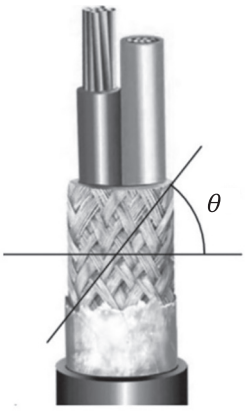


Figure 1 — Angle of lay

3.3.5
bunched conductor
conductor (3.3.13) in which individual strands are assembled together in helical formation, all in the same direction and with the same length of lay

3.3.6
bunching loss
$F_{x,b}$
ratio of *conductor* (3.3.13) resistance before and after the bunching process of *stranded conductors* (3.3.36)

Note 1 to entry: The factor, $F_{x,b}$, is derived by the formula:

$$F_{x,b} = \frac{m_{mean} \cdot R_{mean} \cdot \kappa}{1\ 000 \cdot \rho}$$

where

κ is the conductivity of the used conductor material in Sm/mm^2;

ρ is the density of the conductor material in $kg/dm^3 = kg/l$;

m_{mean} is the mean of measured conductor mass in g/m;

R_{mean} is the mean of measured conductor resistance at 20 °C in mΩ/m.

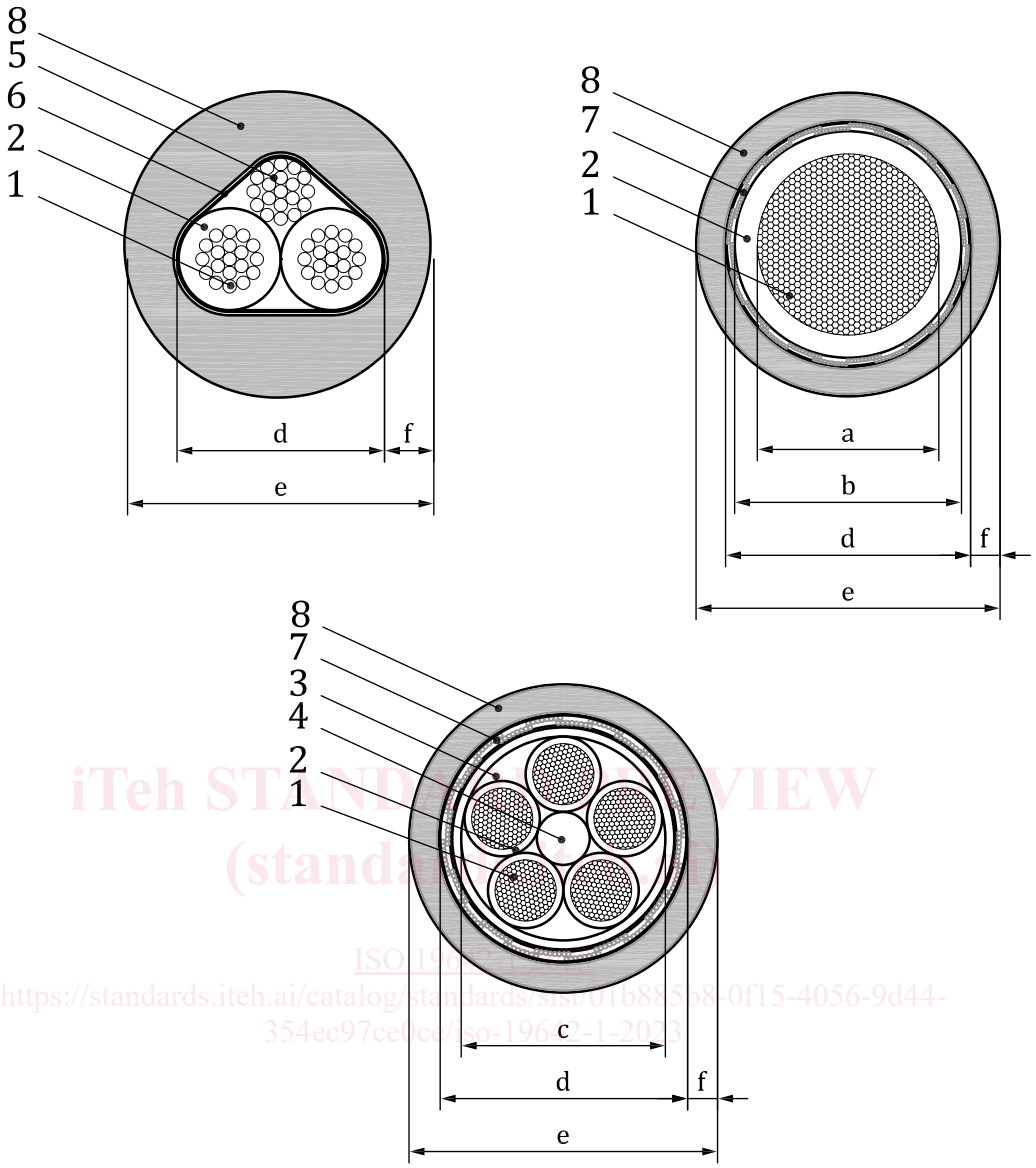
3.3.7
cable
single or multi-core *wire* (3.3.39)

Note 1 to entry: Cable dimension definitions are shown in Figure 2.

3.3.8
cable family
group with multiple *conductor* (3.3.13) sizes having the same conductor, strand coating, *insulation* (3.3.23) formulation, and wall thickness type

3.3.9
cable dimension
property of a *cable* (3.3.7) with physical unit (mm)

Note 1 to entry: Cable dimension definitions are shown in Figure 2.



Key

a	*conductor* (3.3.13) diameter	2	core *insulation* (3.3.23)
b	*core* (3.3.14) diameter	3	*inner covering* (3.3.22)
c	twisted core diameter	4	*filler* (3.3.18)
d	diameter under sheath	5	*drain wire* (3.3.17)
e	outside cable diameter	6	foil
f	wall thickness sheath	7	*screen* (3.3.32)
1	conductor	8	*sheath* (3.3.34)

Figure 2 — Cable dimension definitions

3.3.10
coaxial cable
cable (3.3.7) with one single inner *conductor* (3.3.13), an *insulation* (3.3.23) also called *dielectric* (3.3.16), a concentric cylindrical *screen* (3.3.32) as an outer conductor and a *sheath* (3.3.34)

3.3.11
colour code
code of a *cable* (3.3.7) colour to make it visually distinguishable from the others

Note 1 to entry: The recommended colours are listed in Table 3.

Note 2 to entry: Annex B indicates recommended colour concentrations for the colours listed in Table 3.

Table 3 — Recommended colours and colour codes

Colour	Colour code
Black	BK
Blue	BU
Brown	BN
Green	GN
Orange	OG
Red	RD
Violet (purple)	VT
White	WH
Yellow	YE
NOTE Other colours can be used based on agreement between customer and supplier (see IEC 60757).	

3.3.12
compressed conductor
stranded conductor (3.3.36) in which the interstices between the strands have been reduced by mechanical compression into a circular shape with reduced outside diameter

Note 1 to entry: See Figure 3.

a) Compressed conductor

b) Compressed conductor with *insulation* (3.3.23) only

Figure 3 — Compressed conductor

3.3.13
conductor
one or multitude of bare, coated or cladded electrically conductive strands

3.3.14
core
insulated *conductor* (3.3.13) assembly comprising a conductor with its own *insulation* (3.3.23) (and *screens* (3.3.32), if any)