

# ISO 19642-12:2023-05 (E)

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

<b>Contents</b>		<b>Page</b>
Foreword .....		vi
Introduction .....		vii
<b>1</b>	<b>Scope .....</b>	<b>1</b>
<b>2</b>	<b>Normative references .....</b>	<b>1</b>
<b>3</b>	<b>Terms and definitions .....</b>	<b>1</b>
<b>4</b>	<b>Specifications .....</b>	<b>1</b>
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
<b>5</b>	<b>Requirements for the cable's dielectric cores .....</b>	<b>4</b>
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
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

<b>7</b>	<b>Test overview tables .....</b>	<b>13</b>
<b>7.1</b>	<b>Test table for single cores .....</b>	<b>13</b>
<b>7.2</b>	<b>Test tables for finished cables .....</b>	<b>14</b>
<b>8</b>	<b>Cable types .....</b>	<b>17</b>
<b>8.1</b>	<b>Cable parameters .....</b>	<b>17</b>
<b>8.2</b>	<b>Application requirements .....</b>	<b>19</b>
<b>8.2.1</b>	<b>CAN .....</b>	<b>19</b>
<b>8.2.2</b>	<b>CAN FD .....</b>	<b>19</b>
<b>8.2.3</b>	<b>FlexRay .....</b>	<b>19</b>
<b>8.2.4</b>	<b>100BASE-T1 Ethernet .....</b>	<b>21</b>
<b>8.2.5</b>	<b>1000BASE-T1 Ethernet .....</b>	<b>25</b>
	<b>Annex A (normative) Colour combinations .....</b>	<b>29</b>
	<b>Bibliography .....</b>	<b>30</b>