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Edition 1.0 2017-11

INTERNATIONAL STANDARD

Charging cables for electric vehicles of rated voltages up to and including 0,6/1 kV –
Part 3: Cables for AC charging according to modes 1, 2 and 3 of IEC 61851-1 of rated voltages up to and including 450/750 V

IEC 62893-3:2017-11(en)

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CHARGING CABLES FOR ELECTRIC VEHICLES OF RATED VOLTAGES UP TO AND INCLUDING 0,6/1 kV –

Part 3: Cables for AC charging according to modes 1, 2 and 3 of IEC 61851-1 of rated voltages up to and including 450/750 V

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International Standard IEC 62893-3 has been prepared by IEC technical committee 20: Electric cables.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
20/1762/FDIS	20/1775/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

This document is to be read in conjunction with IEC 62893-1:2017.

A list of all parts in the IEC 62893 series, published under the general title *Charging cables for electric vehicles of rated voltages up to and including 0,6/1 kV*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

CHARGING CABLES FOR ELECTRIC VEHICLES OF RATED VOLTAGES UP TO AND INCLUDING 0,6/1 kV –

Part 3: Cables for AC charging according to modes 1, 2 and 3 of IEC 61851-1 of rated voltages up to and including 450/750 V

1 Scope

This part of IEC 62893 applies to cables for AC charging according to modes 1, 2 and 3 of IEC 61851-1. The cables are of rated voltages U_0/U up to and including 450/750 V. Ordinary duty cables with rated voltage 300/500 V are only permitted for charging mode 1 of IEC 61851-1.

Maximum conductor operating temperature for the cables in this document is 90 ºC.

The test methods specified are given in IEC 62893-2, IEC 60245-2, IEC 60332-1-2, IEC 62821-1:2015, Annex B and in the relevant parts of IEC 60811.

IEC 62440 is intended to be used as guidance on the safe use of cables in this document together with specific guidance in Clause 5 of this document.

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.

IEC 60245-2:1994, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 2: Test methods*

IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

IEC 60811-401:2012, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 401: Miscellaneous tests – Thermal ageing methods – Ageing in an air oven*

IEC 60811-505, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 505: Mechanical tests – Elongation at low temperature for insulations and sheaths*

IEC 61851-1, *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 62440:2008, *Electric cables with a rated voltage not exceeding 450/750 V – Guide to use*

IEC 62821-1:2015, *Electric cables – Halogen-free, low smoke, thermoplastic insulated and sheathed cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 62893-1:2017, *Charging cables for electric vehicles of rated voltages up to and including 0,6/1 kV – Part 1: General requirements*

IEC 62893-2:2017, *Charging cables for electric vehicles of rated voltages up to and including 0,6/1 kV – Part 2: Test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62893-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 General purpose cables

4.1 Ordinary duty flexible cables

4.1.1 Code designation

The code designation is 62893 IEC 121 for halogen free cables with sheath compound EVM-1 and 62893 IEC 122 for halogen free cables with sheath compound EVM-2.

4.1.2 Rated voltage

300/500 V

4.1.3 Construction

4.1.3.1 Sizes of cable

The sizes of cable shall be:

1,5 mm^2 and 2,5 mm^2 – 3 power cores

4.1.3.2 Insulation

The insulation of the power cores shall be compound of type EVI-2 to IEC 62893-1.

4.1.3.3 Assembly

The cores shall be twisted together.

A tape may be applied around the core assembly before application of the sheath.

4.1.3.4 Sheath

The sheath shall be compound of type EVM-1 to IEC 62893-1 for cable type 62893 IEC 121 and EVM-2 to IEC 62893-1 for cable type 62893 IEC 122.

The sheath shall not adhere to the cores. The assembly of cores may be surrounded by a separator and/or filler which shall not adhere to the cores.

The application of the sheath shall give the finished cable a practically circular shape.

4.1.3.5 Marking

The cable shall be marked with the corresponding code designation.

The marking shall comply with Clause 6 of IEC 62893-1:2017.

4.1.4 Requirements

Each cable shall comply with the appropriate requirements given in IEC 62893-1, and the particular requirements of this document.

Testing shall be in accordance with Annex A of this standard, and the relevant tests indicated in column 6 of Table A.1.

a) The thicknesses of insulation and sheath shall conform to Table B.1 for type 121 and Table B.2 for type 122.
b) The requirements to be met for the compatibility test shall be as given in Annex A of IEC 62893-1:2017.
c) The tests conditions and requirements to be met for the cold impact test shall be as given in 5.8 of IEC 62893-2:2017.
d) The tests conditions and requirements to be met for the crush resistance test shall be as given in 5.7 of IEC 62893-2:2017.

4.2 Heavy duty flexible cables

4.2.1 Code designation

The code designation is 62893 IEC 123 for halogen free cables with sheath compound EVM-1 and 62893 IEC 124 for halogen free cables with sheath compound EVM-2.

The code designation is 62893 IEC 125 for cables with sheath compound EVM-3.

4.2.2 Rated voltage

450/750 V

4.2.3 Construction

4.2.3.1 Sizes of cable

The sizes of cable shall be:

power cores:

1,5 mm^2 – 3 cores

2,5 mm^2 to 35 mm^2 – 3, 4 and 5 cores

control or pilot cores: number not specified, for size see 8.2 of IEC 62893-1:2017

4.2.3.2 Insulation

The insulation for power cores shall be compound of Type EVI-2 according to IEC 62893-1.

The insulation for pilot or control cores shall be compound of Type EVI-1 or EVI-2 according to IEC 62893-1.

4.2.3.3 Assembly

The cores shall be twisted together.

A centre filler may be used.

The assembly of cores may be surrounded by a separator and or filler which shall not adhere to the cores.

A screen according to 8.6 of IEC 62893-1:2017 may be applied.

4.2.3.4 Sheath

The sheath shall be compound of type EVM-1 according to IEC 62893-1 for cable type 62893 IEC 123, EVM-2 according to IEC 62893-1 for cable type 62893 IEC 124 and EVM-3 for cable type 62893 IEC 125.

The sheath shall not adhere to the cores.

For circular cables, the application of the sheath shall give the finished cable a practically circular shape.

4.2.3.5 Marking

The cable shall be marked with the corresponding code designation.

The marking shall comply with Clause 6 of IEC 62893-1:2017.

4.2.4 Requirements

Each cable shall comply with the appropriate requirements given in IEC 62893-1, and the particular requirements of this document.

Testing shall be in accordance with Annex A, and the relevant tests indicated in column 7 and column 8 of Table A.1.

a) The thicknesses of insulation and sheath shall conform to Table B.3 for type 123 and Table B.4 for types 124 and 125.
b) The requirements to be met for the compatibility test shall be as given in Annex A of IEC 62893-1:2017.
c) The tests conditions and requirements to be met for the cold impact test shall be as given in 5.8 of IEC 62893-2:2017.
d) The tests conditions and requirements to be met for the crush resistance test shall be as given in 5.7 of IEC 62893-2:2017.

5 Guide to use of the cables

General guidance information given in IEC 62440 shall be used. In addition, the specific information from Table 1 and Table 2 shall be taken into account for the products specified in this document.

Table 1 – Intended use of charging cables for EV (environmental conditions)

1	2	3
Code designation	62893 IEC 121 and 122	62893 IEC 123, 124 and 125
Shape of cable	Round	Round
Conductor construction	Class 5	Class 5
1 Duty [a]		
1.1 Ordinary	+	+
1.2 Heavy	-	+
2 Presence of water		
2.1 Condition AD 7 [b]	+	+
3 Corrosive of polluting substances		
3.1 Condition AF 3 [b]	+	+
4 Impact		
4.1 Condition AG 2 [b]	-	+
5 Vibrations		
5.1 Condition AH 3 [b]	+	+
6 Flora		
6.1 Condition AK 2 [b]	–	-
7 Fauna		
7.1 Condition AL 2 [b]	–	-
8 Outdoor use		
8.1 Condition AN 3 [b]	-	+
8.2 Permanent [c]	+	+
9 Frequent flexing	+	+
10 Frequent torsion	+	+
"+" = acceptable "-" = not suitable		
[a] See Annex C of IEC 62440:2008 for definitions.		
[b] See Annex A of IEC 62440:2008 for definitions.		
[c] See Annex B of IEC 62440:2008 for definitions.		

Table 2 – Recommended use of charging cables for EV

1	2	3
Code designation	**Recommended use**	**Comments**
62893 IEC 121 and 122	Intended for use for charging mode 1 of IEC 61851-1.	Max. storage temperature: +45 °C
62893 IEC 123, 124 and 125	Intended for use for charging modes 1, 2 and 3 of IEC 61851-1.	Min. temperature for installation and handling: –25 °C They are intended for use indoor and outdoor.

Annex A
(normative)

Tests for completed cables

Table A.1 shows tests for cables types 62893 IEC 121, 122, 123, 124 and 125.

Table A.1 – Tests for cable types 62893 IEC 121, 122, 123, 124 and 125

1	2	3	4	5	6	7	8
Ref No.	Tests [a]	Category of test	Test method described in		Applicability of test – Subclause		
			IEC standard	(Sub) clause	62893 IEC 121 and IEC 122	62893 IEC 123 and IEC 124	62893 IEC 125
1	*Electrical tests* [b]						
1.1	Resistance of conductors	T, S	60245-2:1994	2.1	X	X	X
1.2	Voltage test on completed cable	T, S	60245-2:1994	2.2			
	– at 2 000 V AC, 4 000 V DC				X	-	-
	– at 2 500 V AC, 5 000 V DC				-	X	X
1.3	Voltage test on cores according to specified insulation thickness:	T	60245-2:1994	2.3			
1.3.1	– at 1 500 V for insulation thickness up to and including 0,6 mm				X	-	-
1.3.2	– at 2 000 V for insulation thickness exceeding 0,6 mm				X	-	-
1.3.3	– at 2 500 V for insulation thickness exceeding 0,6 mm				-	X	X
1.4	Insulation resistance at 90 °C	T	60245-2:1994	2.4	X	X	X
1.5	Long term resistance of insulation to DC	T	62893-2:–	5.1.1	X	X	X
2	*Constructional and dimensional tests*						
2.1	Checking of compliance with constructional provisions	T, S	62893-1:–		X	X	X
2.2	Measurement of thickness of insulation	T, S	60245-2:1994	1.9	X	X	X
2.3	Measurement of thickness of sheath	T, S	60245-2:1994	1.10	X	X	X
2.4	Measurement of overall dimensions						
2.4.1	Mean value	T, S	60245-2:1994	1.10.2	X	X	X
2.4.2	Ovality	T, S	60245-2:1994	1.11	X	X	X
3	*Insulation material tests*	T	62893-1:–[c]	8.3.1	X	X	X

1	2	3	4	5	6	7	8
Ref No.	**Tests** [a]	**Category of test**	**Test method described in**		**Applicability of test – Subclause**		
			IEC standard	**(Sub) clause**	**62893 IEC 121 and IEC 122**	**62893 IEC 123 and IEC 124**	**62893 IEC 125**
4	*Sheath material tests*	T	62893-1:– [c]	8.7.1	X	X	X
5	*Compatibility test*	T	60811-401:2012 62893-1:2017	4.2.3.4 Annex A	X	X	X
6	Impact test at -35 °C [d]	T	62893-2:2017	5.8	X	X	X
7	*Shrinkage test*	T	62893-1:2017	8.8.6	X	X	X
8	*Mechanical strength of completed cable*	T	62893-1:2017	8.8.3	X	X	X
9	*Crush resistance test*	T	62893-2:2017	5.7	X	X	X
10	*Resistance against chemicals*	T	62893-2:2017	5.3	X	X	X
11 11.1	*Tests under fire conditions* Test on single vertical cable	T	60332-1-2	-	X	X	X
12	*Assessment of halogens for all non-metallic materials*	T, S	62821-1:2015	Annex B	X	X	-

[a] The order given does not imply a sequence of testing.

[b] Particular test conditions and requirements are given in Table 4 of IEC 62893-1:2017.

[c] This standard includes all the test methods and requirements for the material. Material to be tested is taken from the finished cable.

[d] In countries with extreme low temperatures other values may be used.

Annex B
(normative)

Tables for cable dimensions and insulation resistance

NOTE 1 The overall dimensions of cables have been calculated in accordance with IEC 60719.

NOTE 2 Mean overall dimension values in Table B.1, Table B.2, Table B.3 and Table B.4 refer to constructions with two or fewer control core(s) and for unscreened cables only.

Table B.1 – General data for type 121 (EVM-1)

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors	**Thickness of insulation**	**Thickness of sheath**	**Mean overall dimensions[a]**		**Minimum insulation resistance at 90 °C**
			Lower value	**Upper value**	
	Specified value	**Specified value**			
mm^2	mm	mm	mm	mm	MΩ × km
3 x 1,5	0,6	1,0	7,9	10,1	0,094
3 x 2,5	0,6	1,0	9,1	11,5	0,076
[a] Indicative values, for information only.					

Table B.2 – General data for type 122 (EVM-2)

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors	**Thickness of insulation**	**Thickness of sheath**	**Mean overall dimensions[a]**		**Minimum insulation resistance at 90 °C**
			Lower value	**Upper value**	
	Specified value	**Specified value**			
mm^2	mm	mm	mm	mm	MΩ × km
3 x 1,5	0,6	1,5	8,9	11,6	0,009 4
3 x 2,5	0,6	1,6	10,1	13,2	0,007 6
[a] Indicative values, for information only.					

Table B.3 – General data for type 123 (EVM-1)

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors	**Thickness of insulation**	**Thickness of sheath**	**Mean overall dimensions[a]**		**Minimum insulation resistance at 90 °C**
	Specified value	**Specified value**	**Lower value**	**Upper value**	
mm^2	mm	mm	mm	mm	MΩ × km
3 x 1,5	0,7	1,0	8,2	10,5	0,010 5
3 x 2,5	0,7	1,0	9,3	11,9	0,008 6
3 x 4	0,7	1,1	10,8	13,8	0,007 1
3 x 6	0,7	1,2	12,3	15,7	0,006 1
3 x 10	0,7	1,4	14,8	19,0	0,004 9
3 x 16	0,7	1,5	17,6	22,6	0,003 9
3 x 25	0,9	1,7	21,9	28,0	0,004 0
3 x 35	0,9	1,9	24,7	32,9	0,003 3
4 x 2,5	0,7	1,0	10,2	13,1	0,008 6
4 x 4	0,7	1,1	11,9	15,2	0,007 1
4 x 6	0,7	1,2	13,5	17,3	0,006 1
4 x 10	0,7	1,4	16,4	20,9	0,004 9
4 x 16	0,7	1,6	19,7	25,2	0,003 9
4 x 25	0,9	1,9	24,6	31,5	0,004 0
4 x 35	0,9	2,1	28,9	37,0	0,003 3
5 x 2,5	0,7	1,2	11,7	15,0	0,008 6
5 x 4	0,7	1,3	13,5	17,3	0,007 1
5 x 6	0,7	1,4	15,4	19,7	0,006 1
5 x 10	0,7	1,5	18,3	23,4	0,004 9
5 x 16	0,7	1,7	22,0	28,1	0,003 9
5 x 25	0,9	2,0	27,5	35,2	0,004 0
5 x 35	0,9	2,3	32,4	41,5	0,003 3

[a] Indicative values, for information only.

Table B.4 – General data for type 124 (EVM-2) and type 125 (EVM-3)

1	2	3	4	5	6
Number and nominal cross-sectional area of conductors	Thickness of insulation	Thickness of sheath	Mean overall dimensions[a]		Minimum insulation resistance at 90 °C
	Specified value	Specified value	Lower value	Upper value	
mm^2	mm	mm	mm	mm	MΩ × km
3 x 1,5	0,7	1,5	9,2	11,8	0,010 5
3 x 2,5	0,7	1,6	10,5	13,5	0,008 6
3 x 4	0,7	1,7	12,1	15,5	0,007 1
3 x 6	0,7	1,9	13,7	17,5	0,006 1
3 x 10	0,7	2,1	16,3	20,8	0,004 9
3 x 16	0,7	2,4	19,4	24,9	0,003 9
3 x 25	0,9	2,8	24,2	30,9	0,004 0
3 x 35	0,9	3,2	28,4	36,3	0,003 3
4 x 2,5	0,7	1,7	11,6	14,9	0,008 6
4 x 4	0,7	1,9	13,4	17,2	0,007 1
4 x 6	0,7	2,0	15,2	19,4	0,006 1
4 x 10	0,7	2,3	18,1	23,2	0,004 9
4 x 16	0,7	2,6	21,7	27,7	0,003 9
4 x 25	0,9	3,1	27,0	34,5	0,004 0
4 x 35	0,9	3,5	31,7	40,6	0,003 3
5 x 2,5	0,7	1,8	12,9	16,5	0,008 6
5 x 4	0,7	2,0	14,9	19,1	0,007 1
5 x 6	0,7	2,2	16,9	21,7	0,006 1
5 x 10	0,7	2,5	20,3	25,9	0,004 9
5 x 16	0,7	2,8	24,2	31,0	0,003 9
5 x 25	0,9	3,4	30,2	38,7	0,004 0
5 x 35	0,9	3,9	35,6	45,5	0,003 3

[a] Indicative values, for information only.

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IEC 60719, *Calculation of the lower and upper limits for the average outer dimensions of cables with circular copper conductors and of rated voltages up to and including 450/750 V*

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: Mechanical tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

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