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Electric cables — Charging cables for electric vehicles (BT(DE/NOT)259)

National foreword

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Electric cables - Charging cables for electric vehicles (BT(DE/NOT)259)

Câbles électriques - Câbles de charge pour véhicules électriques (BT(DE/NOT)259)

Kabel und Leitungen - Ladeleitung für Elektrofahrzeuge (BT(DE/NOT)259)

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Contents

Page

Tables

Figures

EN 50620:2017 (E)

European foreword 欧洲前言

This document (EN 50620:2017) has been prepared by CLC/TC 20, Electric cables.

本文件（EN 50620:2017）由 CLC/TC 20《电缆》编制。

The following dates are fixed:以下日期是固定的：

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2017-11-12
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1 Scope
范围

This standard specifies design, dimensions and test requirements for halogen-free cables with extruded insulation and sheath having a voltage rating of up to and including 450/750 V for flexible applications under severe condition for the power supply between the electricity supply point or the charging station and the electric vehicle (EV).
本标准规定了具有挤压绝缘和护套（额定电压 450/750 V 及以下）的无卤电缆的设计、尺寸和试验要求，以便在恶劣条件下灵活应用于供电点或电缆槽之间的电源。充电站和电动汽车（EV）。

The EV charging cable is intended to supply power and if needed communication (details see EN 61851-1 and the EN 62196 series) to an electric vehicle. The charging cables are applicable for charging modes 1-3 of EN 61851-1. The cables in this standard with rated voltage 300/500 V are only permitted for charging mode 1 of EN 61851-1.
电动车辆充电电缆用于为电动车辆供电，并在需要时为电动车辆提供通信（详情见 EN 61851-1 和 EN 62196 系列）。充电电缆适用于 EN 61851-1 的充电模式 1-3。本标准中额定电压为 300/500 V 的电缆仅允许用于 EN 61851-1 的充电模式 1。

The maximum conductor operating temperatures for the cables in this standard is 90 °C.
本标准中电缆的最大导体工作温度为 90°C。
The cables may be:电缆可能
a) an integral part of the vehicle (case A of EN 61851-1); or
车辆的组成部分（EN 61851-1 的情况 A）；或

b) a detachable cable assembly with a vehicle connector and AC supply connection to a socket outlet (case B of EN 61851-1); or
带有车辆连接器和交流电源连接至插座的可拆卸电缆组件（EN 61851-1 的案例 B）；或

c) permanently attached to a fixed charging point (case C of EN 61851-1).
永久性连接到固定充电点（EN 61851-1 的情况 C）。

This standard describes cables whose safety and reliability is ensured when they are installed and/or used in accordance to the guide to use EN 50565-1 and Annex B.
本标准描述了按照使用指南 EN 50565-1 和附录 B 安装和/或使用时确保安全性和可靠性的电缆。

2 Normative references
规范性引用文件

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.
以下全部或部分文件在本文件中被规范引用，对于其应用是必不可少的。凡是注日期的引用文件，仅引用的版本适用。凡是不注日期的引用文件，其最新版本（包括任何修改）适用。

EN 228, *Automotive fuels — Unleaded petrol — Requirements and test methods*
EN 228，汽车燃料-无铅汽油-要求和试验方法

EN 590, *Automotive fuels — Diesel — Requirements and test methods*

EN 50289-1-5:2001, *Communication cables — Specifications for test methods — Part 1-5: Electrical test methods - Capacitance*

EN 50289-4-17, *Communication cables — Specifications for test methods — Part 4-17: Test methods for UV resistance evaluation of the sheath of electrical and optical fibre cable*

EN 50334, *Marking by inscription for the identification of cores of electric cables*

EN 50395:2005, *Electrical test methods for low voltage energy cables*

EN 50396:2005, *Non electrical test methods for low voltage energy cables*

EN 50525-1:2011, *Electric cables — Low voltage energy cables of rated voltages up to and including 450/750 V (U0/U) — Part 1: General requirements*

EN 60228, *Conductors of insulated cables (IEC 60228)*

EN 60332-1-2:2004/A1:2015, *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 60332-1-2:2004*/A1:2015*)*

EN 50620:2017 (E)

EN 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 60719)*

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

EN 60811-403, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 403: Miscellaneous tests — Ozone resistance test on cross-linked compounds (IEC 60811-403)*

EN 60811-404, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 404: Miscellaneous tests — Mineral oil immersion tests for sheaths (IEC 60811-404)*

EN 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 (IEC 60811-501)*

EN 60811-503, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 503: Mechanical tests — Shrinkage test for sheaths (IEC 60811-503)*

EN 60811-504, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 504: Mechanical tests — Bending tests at low temperature for insulation and sheaths (IEC 60811-504)*

EN 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 60811-505)*

EN 60811-506, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 506: Mechanical tests — Impact test at low temperature for insulations and sheaths (IEC 60811-506)*

EN 60811-507, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 507: Mechanical tests — Hot set test for cross-linked materials (IEC 60811-507)*

EN 60811-508, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 508: Mechanical tests — Pressure test at high temperature for insulation and sheaths (IEC 60811-508)*

EN 60811-509, *Electric and optical fibre cables — Test methods for non-metallic materials — Part 509: Mechanical tests — Test for resistance of insulations and sheaths to cracking (heat shock test) (IEC 60811-509)*

EN 61851-1, *Electric vehicle conductive charging system — Part 1: General requirements (IEC 61851-1)*

EN 62230, *Electric cables — Spark-test method (IEC 62230)*
HD 308 S2, *Identification of cores in cables and flexible cords*
HD 605 S2:2008, *Electric cables — Additional test methods*
ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 14572:2011, *Road vehicles — Round, sheathed, 60 V and 600 V screened and unscreened single- or multi-core cables — Test methods and requirements for basic- and high-performance cables*

ISO 22241-1, *Diesel engines — NOx reduction agent AUS 32 — Part 1: Quality requirements*

3 Terms and definitions 术语和定义

For the purposes of this document, the following term s and definitions apply.
在本文件中，以下术语和定义适用

3.1
type test 型式试验
T
test required to be made before supplying a type of cable covered by this standard on a general commercial basis, in order to demonstrate satisfactory performance characteristics to meet the intended application
在提供本标准所涵盖的电缆之前，应在一般商业基础上进行测试，以证明满足预期应用的令人满意的性能特征。

Note 1 to entry: Type tests are of such a nature that, after they have been made, they need not be repeated unless changes are made in the cable materials, design or type of manufacturing process which might change the performance characteristics
.注 1：型式试验的性质是，在试验完成后，除非电缆材料、设计或制造工艺类型发生可能改变性能特性的变化，否则不需要重复进行试验。

3.2
sample test 样品测试
S
test made on samples of completed cable, or components taken from a completed cable adequate to verify that the finished product meets the design specifications
对已完成电缆样品或从已完成电缆中提取的部件进行的试验，足以验证成品是否符合设计规范。

3.3
routine test 例行试验
R
tests made on all production cable lengths to demonstrate their integrity
对所有生产电缆长度进行测试，以证明其完整性。

3.4
halogen-free material 无卤材料
when used in cables designated halogen-free, material complying with the assessment of halogen requirements in Table 5
当用于无卤电缆时，材料应符合表 5 中卤素要求的评估。

3.5
type of compound 化合物类型
category in which a compound is placed according to its properties, as determined by specific tests
根据特定试验确定的化合物性质放置的类别。

Note 1 to entry: The type designation is not directly related to the composition of the compound.
注 1：类型名称与化合物的组成没有直接关系。

3.6
EVI
insulation compound for cables in this standard
本标准电缆用绝缘化合物

3.7
EVM
sheathing compound for cables in this standard
本标准电缆护套料

3.8
CP core
control pilot core 控制导向芯
core in the cable which serve the basic control function to operate a charging cable
电缆中的芯线，用于操作充电电缆的基本控制功能

Note 1 to entry: For further information see EN 61851-1.
条目注 1：更多信息见 EN 61851-1

3.9
CC
control core 控制核心
core in the cable for additional control and measurement functions
用于附加控制和测量功能的电缆芯

4 Rated voltage 额定电压

The rated voltage of a cable is the reference voltage for which the cable is designed.
电缆的额定电压是电缆设计的参考电压。

The rated voltage in an alternating current system, is expressed by the combination of two values *U*0/*U*, expressed in volts, where:
交流系统中的额定电压由两个值的组合表示。u0/u，单位为伏特，其中：

a) *U*0 is the r.m.s. value between any insulated conductor and “earth” (metal covering of the cable or the surrounding medium);
U0 是任何绝缘导体与“接地”（电缆的金属覆盖层或周围介质）之间的 r.m.s.值；

b) *U* is the r.m.s. value between any two phase conductors of a multicore cable or of a system of single core cables.
U 是多芯电缆或单芯电缆系统的任何两相导体之间的 R.M.S.值。

In an alternating current system, the rated voltage of a cable or cord shall be at least equal to the nominal voltage of the system for which it is intended. This condition applies to the values of both *U*0 and *U*.
在交流系统中，电缆或电线的额定电压应至少等于其预期系统的额定电压。此条件适用于 U0 和 U 的值。

The operating voltage of a system may permanently exceed the nominal voltage of the system. The maximum permanent permitted operating voltage of the cable is stated in Table 1.
系统的工作电压可能永远超过系统的额定电压。电缆的最大永久允许工作电压见表 1。

Table 1 — Examples of maximum permitted voltages against rated voltage of cable
电缆额定电压的最大允许电压示例

Rated voltage of cable	Maximum permanent permitted operating voltage of the cable	
	a.c.	3-phase a.c.
*U*0/*U*	Conductor-earth	Conductor-conductor
V	*U*0 max (V)	*U* max (V)
300/500	320	550
450/750	480	825

5 Marking 标记

5.1 Indication of origin 原产地说明

Cables shall be provided with an identification of origin consisting of:
电缆应具有原产地标识，包括：

a) either the manufacturer's identification thread;
制造商的识别线；

b) or the continuous marking of the manufacturer's name or his trademark, or (if legally protected) his identification number, by one of the three following methods:
或制造商名称或商标的连续标记，或（如果受法律保护）他的身份证号码，采用以下三种方法之一：
1) printed tape within the cable;
电缆内的印刷带；
2) printing, indenting or embossing on the insulation of at least one core. Any core may be chosen;
在至少一个磁芯的绝缘层上印刷、压印或压印。可以选择任何核心
3) printing, indenting or embossing on the sheath.
护套上的印刷、压痕或压印

5.2 Continuity of marking 标记连续性

Each specified marking shall be regarded as continuous if the distance between the end of the mark and the beginning of the next identical mark does not exceed:
如果标志的末端与下一个相同标志的开头之间的距离不超过：
a) 550 mm if the marking is on the outer sheath of the cable;
如果标记在电缆外护套上，则为 550 mm

b) 275 mm if the marking is:275mm，如果标记为

1) on the insulation of a sheathed cable;
在护套电缆的绝缘上
2) on a tape within a sheathed cable.
在带护套电缆内的胶带上

NOTE A "Specified Marking" is any marking that is prescribed as a normative requirement by this EN.
注："规定标记"是本 EN 规定为规范性要求的任何标记。

Other marking, such as that required under recognized voluntary third party approval schemes, may also follow the requirements of this subclause.
其他标记，如公认的自愿第三方批准计划中要求的标记，也可遵循本款的要求。

Figure 1 shows an example of the marking as used on the outer sheath of the cable.
图 1 显示了电缆外护套上使用的标记示例。

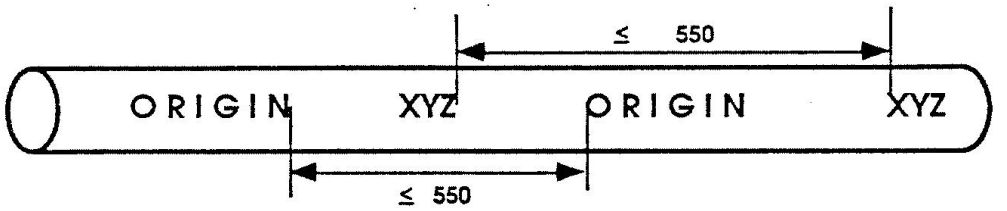

Figure 1 — Example of marking 图 1-
标记示例

5.3 Use of the name CENELEC 名称的使用

The name CENELEC, in full or abbreviated, shall not be marked on, or in the cables.
不应在电缆上或电缆中标明欧洲电工标准化委员会的全名或缩写。

5.4 Code designation 代码名称

Each cable shall have its full code designation according to requirements in this standard marked continuously (see 5.2) on the sheath:
根据本标准的要求，每根电缆应具有完整的代号，并在护套上连续标记（见 5.2）：

— EVC (Electric Vehicle Cable);
电动汽车电缆

— code designation: H05BZ5-F or H05BZ6-F or H07BZ5-F or H07BZ6-F;
代号：H05BZ5-F 或 H05BZ6-F 或 H07BZ5-F 或 H07BZ6-F

— number and nominal cross section of power cores;
电力线芯数量及名义截面

— additional core(s) (CC and/or CP) with number and nominal cross section, if any;
附加芯（CC 和/或 CP），带编号和标称横截面（如有）

— rated voltage;
额定电压

— number of cable standard.
电缆标准编号

EXAMPLE For code designation: EVC H07BZ5-F 5 × 6 + 2x0,5 450/750 V EN 50620
代码名称示例：EVC H07BZ5-F 5×6+2x0,5 450/750 V EN 50620

5.5 Additional voluntary marking 附加自愿标记

Additional markings, for example the year of manufacture, are permitted, but are not requirements of this standard. If an additional marking is applied it shall neither conflict nor interfere with the required markings in 5.1 and 5.4. Any additional voluntary marking shall be throughout the length of the cable, and shall be on the external surface of the cable.
允许附加标记，例如制造年份，但不属于本标准的要求。如果使用了附加标记，则不得与 5.1 和 5.4 中要求的标记冲突或干扰。任何附加的自愿标记应贯穿电缆的整个长度，并应位于电缆的外表面。

Such markings, which are permitted to be applied on the same line as the obligatory marking, or on an additional line, shall be repeated at intervals not exceeding 1 100 mm.
允许在强制性标记的同一条线上或在另一条线上使用的此类标记应以不超过 1100 mm 的间隔重复使用。

5.6 Additional requirements 附加要求

5.6.1 Durability 耐久性

Printed markings shall be durable. Compliance with this requirement shall be checked by the test given in EN 50396:2005, 5.1.
印刷标记应耐用。应通过 EN 50396:2005 第 5.1 条中给出的试验检查是否符合本要求。

5.6.2 Legibility 易读性

All markings shall be legible.
所有标记应清晰可见。

The colours of the identification threads shall be easy to recognize or easily made recognizable, if necessary by cleaning with any permitted safe petroleum-based solvent.
如有必要，用任何允许的安全石油基溶剂清洗，识别螺纹的颜色应易于识别或易于识别。

6 Requirements for the construction of cables 电缆施工要求

6.1 Conductors 导体

6.1.1 Material 材料

The conductors shall be class 5 flexible copper conductors in accordance with EN 60228.
导线应为符合 EN 60228 的 5 级软铜导线

The wires of conductors shall be plain or metal coated, for example with tin or silver. Coated wires shall be covered with a continuous layer of the coating. There shall be no visible gaps in the continuous layer, when examined with normal or corrected vision.
导线的导线应为平的或金属涂层，例如锡或银。涂层钢丝应覆盖一层连续的涂层。用正常或矫正视力检查时，连续层中不得有可见间隙。

6.1.2 Electrical resistance 电阻

The resistance of each conductor at 20 °C shall be in accordance with the requirements of EN 60228.
Compliance shall be checked by the test given in EN 50395:2005, Clause 5.
每根导线在 20°C 下的电阻应符合 EN 60228 的要求。应通过 EN 50395:2005 第 5 条中给出的试验检查符合性。

6.2 Sizes of cable

The sizes of cable shall be:
电缆尺寸应为

— power cores 300/500 V – 1,5 mm^2 and 2,5 mm^2 - 3 core;
电源线芯 300/500 V–1.5 mm 2 和 2.5 mm 2-3 芯

— power cores 450/750 V – 1,5 mm^2 3 core and 2,5 mm^2 to 35 mm^2 - 3, 4 and 5 core;
电源线芯 450/750 V–1.5 平方毫米 3 芯和 2.5 平方毫米至 35 平方毫米-3、4 和 5 芯；

— CC/CP cores– 0,5 mm^2 and 1,0 mm^2 - number of cores not specified.
CC/CP 芯–0.5 mm 2 和 1.0 mm 2-未规定芯数

6.3 Insulation 绝缘

6.3.1 Material 材料

The insulation shall be halogen-free compound EVI-2 for power cores, and EVI-1 or EVI-2 for CC/CP cores.
电源线芯的绝缘应为无卤化合物 EVI-2，CC/CP 线芯的绝缘应为 EVI-1 或 EVI-2。

In all cases the insulation shall meet the requirements given in Table 2.
在所有情况下，绝缘应符合表 2 中给出的要求。

6.3.2 Application to the conductor 适用于导线

The insulation shall be applied by extrusion, such that it fits closely on the conductor, but it shall be possible to remove it without damage to the insulation itself, to the conductor or to the metal coating, if present. It is permitted to apply the insulation in a single layer, or in a number of coherent layers.
绝缘应采用挤压方式，使其与导体紧密结合，但应能在不损坏绝缘本身、导体或金属涂层（如有）的情况下将其移除。允许在单层或多个相干层中应用绝缘层。

Where more than one layer is used, all testing shall be carried out on the complete insulation as though it were a single layer.
如果使用了不止一层，则应在整个绝缘层上进行所有试验，就像它是一个单层一样。

NOTE Insulation applied in more than one layer does not conform to the definition of “double insulation” given, for instance, in HD 60364.
注：一层以上的绝缘不符合“双重绝缘”的定义，例如 HD 60364 中给出的定义。

Compliance shall be checked by inspection and by manual test.
应通过检查和手动试验检查是否符合要求。

6.3.3 Thickness 厚度

The mean value of the thickness of insulation of the power cores shall be not less than the specified value for each size of cable shown in the Table 4a and 4b.
电源线芯绝缘厚度的平均值应不小于表 4a 和 4b 所示每种尺寸电缆的规定值。

However, the thickness at any place may be less than the specified value provided that the difference does not exceed 0,1 mm + 10 % of the specified value.
但是，任何地方的厚度都可以小于规定值，前提是其差异不超过规定值的 0.1 mm+10%。

Compliance shall be checked by the test given in EN 50396:2005, 4.1.
应通过 EN 50396:2005 第 4.1 条中给出的试验检查符合性。

For CP/CC cores the minimum wall thickness at any point shall not be less than 0,33 mm.
对于 CP/CC 芯，任何点的最小壁厚不得小于 0.33 mm。

6.3.4 Core identification 核心识别

6.3.4.1 General 概述

Each power core in the cable shall be identified by colour, see 6.3.4.2.
电缆中的每个电源线芯应采用颜色进行标识，见 6.3.4.2。

Each control and/or pilot core (CP/CC) in the cable shall be identified either by colour, see 6.3.4.2 or numbering, see 6.3.4.3.
电缆中的每个控制和/或导缆芯（CP/CC）应通过颜色进行标识，见 6.3.4.2 或编号，见 6.3.4.3。

6.3.4.2 Core identification by colours 用颜色识别芯

6.3.4.2.1 General requirements 一般要求

Identification of the cores of a cable shall be achieved by the use of coloured insulation or by a coloured surface like in EN 50525-1:2011.
电缆芯线的识别应通过使用彩色绝缘或彩色表面实现，如 EN 50525-1:2011 中所述。

Each core of a cable shall have only one colour, except the core identified by a combination of the colours green-and-yellow.
电缆的每个芯线应只有一种颜色，但通过绿色和黄色组合标识的芯线除外。

The green-and-yellow core, if any, shall comply with the requirement of 6.3.4.3.
绿芯和黄芯（如有）应符合 6.3.4.3 的要求。

The colours green and yellow, when not in combination, shall not be used for any multicore cable.
绿色和黄色不可用于任何多芯电缆。

6.3.4.2.2 Colour scheme 颜色方案

Colour scheme for power cores shall be in accordance with HD 308 S2:
电源线芯的颜色方案应符合 HD 308 S2：

— three-core cable: green-and-yellow, blue, brown;

三芯电缆：绿黄、蓝、棕

— four-core cable: green-and-yellow, brown, black, grey;

绿色和黄色、棕色、黑色、灰色

— five-core cable: green-and-yellow, blue, brown, black, grey.

绿色和黄色、蓝色、棕色、黑色、灰色

The colours of pilot and/or control cores shall be clearly indentified and different to the power cores.

导频和/或控制磁芯的颜色应清楚标识，并与电源磁芯不同。

The colours shall be clearly identifiable and durable. Durability shall be checked by the test given in EN 50396:2005, 5.1.

颜色应清晰可辨，经久耐用。耐久性应通过 EN 50396:2005 5.1 中给出的试验进行检查。

6.3.4.2.3 Colour combination green-and-yellow 绿色和黄色组合

The combination of the colours green-and-yellow shall be such that, on any 15 mm length of the core, one of these colours covers at least 30 % and not more than 70 % of the surface of the core, the other colour covering the remainder of that surface.
绿色和黄色的组合应确保，在芯线的任何 15 mm 长度上，其中一种颜色至少覆盖芯线表面的 30%至 70%，另一种颜色覆盖芯线表面的其余部分。

NOTE This requirement is in accordance with EN 60445.
注：该要求符合 EN 60445。

Compliance shall be checked using one of the test methods in EN 50396:2005, 5.2.
应使用 EN 50396:2005 第 5.2 条中的一种试验方法检查符合性。

6.3.4.3 Core identification by numbers for control, pilot (CC,CP) cores 控制芯、导频（CC、CP）芯的编号识别

6.3.4.3.1 General requirements 一般要求

The insulation of the cores shall be of the same colour and numbered sequentially.
The numbering shall start by number 1.
芯线的绝缘应具有相同的颜色，并按顺序编号。编号从 1 开始。
The numbers shall be printed in arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of the insulation. The numerals shall be legible.
数字应以阿拉伯数字印刷在芯的外表面上。所有编号的颜色应相同，与绝缘材料的颜色形成对比。数字应清晰可辨。

6.3.4.3.2 Preferred arrangement of marking 标记的首选安排

The numbers shall be repeated, at regular intervals along the core in accordance with the axial arrangement described in EN 50334.
应按照 EN 50334 中所述的轴向布置，沿堆芯定期重复编号

6.3.4.3.3 Durability 耐久性

Printed numerals shall be durable. Compliance with this requirement shall be checked by the test given in EN 50396:2005, 5.2.
印刷数字应经久耐用。应通过 EN 50396:2005 第 5.2 条中给出的试验检查是否符合本要求。

6.4 Assembly of cores 堆芯的组装

The cores shall be twisted together. A tape may be applied over the core assembly.
芯线应绞合在一起。可在芯组件上使用胶带。
A centre-core is not permitted. A centre-filler of suitable material may be applied.
不允许使用中心芯。可使用合适材料的中心填料
The maximum length of lay shall be not more than 20 times the diameter of the assembly of laid up cores.
铺设的最大长度不得超过叠芯组件直径的 20 倍。

6.5 Other components 其他组成部分

6.5.1 General 概述

Interstitial fillers may be included in the construction of the cables.
电缆结构中可能包括填隙填料。

6.5.2 Interstitial fillers 填隙料

6.5.2.1 Composition 组成

Fillers shall be composed of one of the following or of any combination of the following:
填料应包括以下任何一种或以下任何组合：
— a compound based on polymeric materials; or
基于聚合物材料的化合物；或
— natural or synthetic textiles; or
天然或合成纺织品；或
— paper.
纸

6.5.2.2 Requirements
要求

Fillers shall fill the spaces between the cores, and shall not adhere to the cores. The fillers shall be capable of being removed without damage to the cores.
填料应填充芯之间的空隙，不得粘附在芯上。填料应能在不损坏芯的情况下移除。

There shall be no harmful interactions between the fillers and the insulation and/or the sheath. Compliance shall be checked as part of the compatibility test requirements.
填料与绝缘层和/或护套之间不得存在有害的相互作用。作为兼容性试验要求的一部分，应检查符合性。

6.6 Sheath 护套

6.6.1 Material 材料

The sheath compound EVM-1 (Z5) or EVM-2 (Z6) shall be used. The requirements for the sheath materials are specified in Table 3.
应使用护套化合物 EVM-1（Z5）或 EVM-2（Z6）。护套材料的要求见表 3。

6.6.2 Application 应用

The sheath shall be applied by extrusion and shall consist of a single layer or two adherent layers.
护套应采用挤压方式，由单层或两层粘合层组成

The sheath shall not adhere to the cores, and shall be capable of being removed without damage to the cores.
护套不应粘附在芯上，并且应能够在不损坏芯的情况下移除。

Assemblies of cores shall be surrounded by tapes, or by the sheath itself, or by a combination of these. In all cases there shall be no substantial cavities between the assembled cores and the next immediate layer.
芯线组件应被胶带、护套或其组合包围。在任何情况下，组装好的芯和下一层之间都不应存在实质性的空腔。

In some case interstitial fillers may be allowed and may also fill any such cavities.
在某些情况下，可以使用填隙物，也可以填充任何此类空腔。

The application of the sheath shall give the finished cable a practically circular shape.
护套的应用应使成品电缆实际上呈圆形。

6.6.2.1 Sheath in a single layer 单层护套

The sheath shall be applied as a homogeneous layer either EVM-1 or EVM-2.
护套应为均匀层，即 EVM-1 或 EVM-2。

6.6.2.2 Sheath in two layers 两层护套

a) Inner layer.内层

The inner layer of the sheath shall be EVI-2. b) Outer layer.
护套内层应为 EVI-2。b）外层

The outer layer of the sheath shall be EVM-2. Layers shall be bonded together.
护套外层应为 EVM-2。各层应粘合在一起

6.6.3 Thickness 厚度

The mean value of the thickness of the sheath shall be not less than the specified value for each type and size of cable shown in the Table 4a and 4b.
护套厚度的平均值应不小于表 4a 和 4b 所示每种类型和尺寸电缆的规定值。

However, the thickness at any place may be less than the specified value provided that the difference does not exceed 0,1 mm + 15 % of the specified value.
但是，任何地方的厚度都可能小于规定值，前提是其差异不超过规定值的 0.1 mm+15%。

For two-layer constructions the inner layer shall be maximum of 40 % of the specified value for wall thickness in Table 4b for the particular type of cable.
对于双层结构，对于特定类型的电缆，内层最大应为表 4b 中规定壁厚值的 40%

EN 50620:2017 (E)

Compliance shall be checked by the test given in EN 50396:2005, 4.2 or 4.3.
应通过 EN 50396:2005、4.2 或 4.3 中给出的试验检查符合性。

6.6.4 Colour 颜色

The colour shall be throughout the whole of the sheath (or the whole of the outer layer in a two layer construction).
颜色应贯穿整个护套（或两层结构的整个外层）

Durability shall be checked by the test given in EN 50396:2005, 5.1.
耐久性应通过 EN 50396:2005 5.1 中给出的试验进行检查。

For permanent outdoor use, the sheath shall be protected against discoloration due to UV.
对于永久性户外使用，应保护护套免受紫外线引起的变色。

7 Requirements 要求

Each cable shall comply with the requirements given in this European Standard.
每根电缆应符合本欧洲标准中给出的要求。

Testing shall be in accordance with Table 5.试验应符合表 5 的要求。

NOTE For non-electrical tests on sheaths in two layers see EN 50525–1:2011, 5.6.2.3, c).
关于两层护套的非电气试验，请参见 EN 50525–1:2011，5.6.2.3，c）

The dimensions of the cables shall conform to Table 4a or 4b for the relevant size.
电缆尺寸应符合表 4a 或 4b 中有关尺寸的规定。

The requirements to be met for the compatibility test shall be as given in Annex A.
兼容性试验应符合附录 A 中的要求。

Table 2 — Requirements for halogen free insulation compounds

无卤绝缘化合物的要求

1	2	3	4	5	6	7
Ref. No.	Test	Unit	试验方法描述见		化合物类型	
			标准	条款	EVI-1	EVI-2
1	**机械特性**					
1.1	老化前性能	N/mm^2	EN 60811–501			
1.1.1	拉伸强度值：				15,0	8,0
	– median, min.					
	断裂伸长值:	%				
1.1.2	– median, min.				300	200
1.2	烘箱老化后的性能		EN 60811–401			
1.2.1	老化条件:					
	– temperature	°C			135 ± 2	135 ± 2
	– duration of treatment	h			7 × 24	7 × 24
1.2.2	拉伸强度值:					
	– median, min.	N/mm^2			–	–
	– variation, max.	%			± 30	± 30
1.2.3	断裂伸长值:					
	– median, min.	%			–	–
	– variation, max.				± 30	± 30
1.3	热延伸试验		EN 60811–507			
1.3.1	Conditions 条件					
	– Temperature 温度	°C min			–	200 ± 3
	– Time under load 加载时间				–	15
	– mechanical stress 机械应力	N/cm^2			–	20
	Values to be obtained 要获得的值					
1.3.2	– elongation under load, max.最大载荷下的延伸率	%			–	100
	– permanent elongation after cooling,冷却后的永久延伸率 max.	%			–	25
1.4	高温压力试验		EN 60811–508			
1.4.1	Conditions 条件					
	- duration of heating under load 带负荷加热时间	h			4	
	- temperature 温度	°C			120 ± 2	
1.4.2	Result to be obtained 要获得的结果					
	Median of the depth of indentation, max 压痕深度的中间值，最大值	%			50	
1.5	Cold elongation test 冷伸长试验		EN 60811–505			
1.5.1	Conditions:条件					
	– temperature 温度	°C			–40 ± 2	–40 ± 2
	Values to be obtained:要获得的值					
1.5.2	– elongation at break, min.最小断裂延伸率	%			30	30
1.6	Shore hardness 肖氏硬度	IRHD	ISO 48			≥ 80 (IRHD)
		Shore D	HD 605 S2:2008	2.2.1	≥ 50 (D)	

Table 3 — 无卤护套化合物的要求

1	2	3	4	5	6	7
Ref. No.	Test	Unit	Test method described in		Type of compound	
			standard	clause	EVM-1	EVM-2
1	机械特性					
1.1	Properties before ageing 老化前性能		EN 60811–501			
1.1.1	Values to be obtained for the tensile strength:拉伸强度值 – median, min.	N/mm^2			20,0	10,0
1.1.2	Values to be obtained for the elongation at break:断裂伸长值 – median, min.	%			300	150
1.2	Properties after ageing in oven		EN 60811–401			
1.2.1	烘箱老化后的性能 Ageing conditions: 老化条件					
	– temperature 温度	°C			110 ± 2	120 ± 2
1.2.2	– duration of treatment 治疗持续时间	h			7 × 24	7 × 24
	Values to be obtained for the tensile strength:拉伸强度值	N/mm^2			–	–
	– median, min.	%			± 30	± 30
1.2.3	– variation, max.变化，最大值 Values to be obtained for the elongation at break: 断裂伸长值	%			300	–
	– median, min.	%			± 30	± 30
	– variation, max.					
1.3	Hot set test 热定型试验		EN 60811–507			
1.3.1	Conditions 条件					
	– Temperature 温度	°C min			–	250 ± 3
	– Time under load 加载时间	N/cm^2			–	15
	– mechanical stress 机械应力				–	20
1.3.2	Values to be obtained 要获得的值 – elongation under load, max.最大载荷下的延伸率	%			–	100
	ermanent elongation after cooling, max.冷却后的永久延伸率，最大值	%			–	25
1.4	Cold elongation test 冷伸长试验		EN 60811–505			
1.4.1	Conditions:条件 – temperature 温度	°C			–40 ± 2	–40 ± 2
1.4.2	Values to be obtained:要获得的值 – elongation at break, min.最小断裂延伸率	%			30	30

1	2	3	4	5	6	7
Ref. No.	Test	Unit	Test method described in		Type of compound	
			standard	clause	EVM-1	EVM-2
1.5	Requirements after water immersion 浸水后要求		EN 50396:2005	10.3		
1.5.1	Test conditions 试验条件					
	– Temperature 温度	°C			80 ± 2	70 ± 2
	– Time under load 加载时间	h			7 × 24	7 × 24
1.5.2	Values to be obtained 要获得的值					
	– median, elongation, min. 中间值，延伸率，最小值	%			300	-
	– variation, elongation, max. 变化，延伸率，最大值	%			± 30	± 30
	– variation, tensile load, max 最大拉伸载荷变化	%			± 30	± 30
1.6	Properties after immersion in mineral oil IRM 902 矿物油浸泡后的性能		EN 60811–404			
1.6.1	test conditions:试验条件					
	– temperature 温度	°C			100 ± 2	100 ± 2
	– duration of treatment 治疗持续时间	h			7 × 24	7 × 24
1.6.2	Values to be obtained for the tensile strength:拉伸强度值					
	– variation, max.变化，最大值	%			± 40	± 40
1.6.3	Values to be obtained for the elongation at break:断裂伸长值					
	– median, min.中位数，最小值	%			300	–
	– variation, max.变化，最大值	%			± 30	± 40
1.7	Heat shock test 热冲击试验		EN 60811–509			
1.7.1	Test conditions: 试验条件					
	-temperature 温度	°C			150 ± 2	-
	- duration of treatment 治疗持续时间	h			1	-
1.7.2	Results to be obtained 要获得的结果				No cracks	-
1.8	Pressure test at high temperature 高温压力试验		EN 60811–508			
1.8.1	Test conditions: 试验条件					
	- duration of heating under load 带负荷加热时间	h			4	
	- temperature 温度	°C			100 ± 2	
1.8.2	Result to be obtained 要获得的结果					
	Median of the depth of indentation, max 压痕深度的中间值，最大值	%			50	
1.9	Tear strength 撕裂强度 Mean value to be obtained, min 待测平均值，min	N/mm	EN 50396:2005	10.2	40	10
2.0	Resistance against saponification 抗皂化性 Mean value to be obtained, max 要获得的平均值，最大值	mg of KOH/kg	EN 50396:2005	10.1	200	-

EN 50620:2017 (E)

Table 4a — Dimensional and insulation resistance values of H05BZ5-F and H07BZ5-F [a]

	1	2	3	4	5	6	7
Rated voltage U_0/U	**Number and nominal cross sectional area of conductors**	**Insulation thickness power core Specified value**	**Sheath thickness Specified value**	**Mean overall diameter Lower limit Informative value**	**Mean overall diameter Upper limit Informative value**	**Minimum insulation resistance at 20 °C**	**Minimum insulation resistance at 90 °C**
V	mm^2	mm	mm	mm	mm	MΩ·km	MΩ·km
300/500	3 × 1,5	0,6	1,0	7,9	10,1	9,4	0,0094
300/500	3 × 2,5	0,6	1,0	9,1	11,5	7,6	0,0076
450/750	3 × 1,5	0,7	1,0	8,2	10,5	10,5	0,0105
450/750	3 × 2,5	0,7	1,0	9,3	11,9	8,6	0,0086
450/750	3 × 4	0,7	1,1	10,8	13,8	7,1	0,0071
450/750	3 × 6	0,7	1,2	12,3	15,7	6,1	0,0061
450/750	3 × 10	0,7	1,4	14,8	19,0	4,9	0,0049
450/750	3 × 16	0,7	1,5	17,6	22,6	3,9	0,0039
450/750	3 × 25	0,9	1,7	21,9	28,0	3,9	0,0039
450/750	3 × 35	0,9	1,9	25,7	32,9	3,3	0,0033
450/750	4 × 2,5	0,7	1,0	10,2	13,1	8,6	0,0086
450/750	4 × 4	0,7	1,1	11,9	15,2	7,1	0,0071
450/750	4 × 6	0,7	1,2	13,5	17,3	6,1	0,0061
450/750	4 × 10	0,7	1,4	16,4	20,9	4,9	0,0049
450/750	4 × 16	0,7	1,6	19,7	25,2	3,9	0,0039
450/750	4 × 25	0,9	1,9	24,6	31,5	3,9	0,0039
450/750	4 × 35	0,9	2,1	28,9	37,0	3,3	0,0033
450/750	5 × 2,5	0,7	1,2	11,7	15,0	8,6	0,0086
450/750	5 × 4	0,7	1,3	13,5	17,3	7,1	0,0071
450/750	5 × 6	0,7	1,4	15,4	19,7	6,1	0,0061
450/750	5 × 10	0,7	1,5	18,3	23,4	4,9	0,0049
450/750	5 × 16	0,7	1,7	22,0	28,1	3,9	0,0039
450/750	5 × 25	0,9	2,0	27,5	35,2	3,9	0,0039
450/750	5 × 35	0,9	2,3	32,4	41,5	3,3	0,0033
表 4a 中的平均外形尺寸值是指具有一个或两个控制芯的结构。							

The overall dimensions of cables have been calculated in accordance with EN 60719.
根据 EN 60719 计算了电缆的外形尺寸。

Table 4b — Dimensional and insulation resistance values of H05BZ6-F and H07BZ6-F [a]

	1	2	3	4	5	6	7
Rated voltage U_0/U	**Number and nominal cross sectional area of conductors**	**Insulation thickness** **power core** **Specified value**	**Sheath thickness** **Specified value**	**Mean overall diameter Lower limit** **Informative value**	**Mean overall diameter Upper limit** **Informative value**	**Minimum insulation resistance at 20 °C**	**Minimum insulation resistance at 90 °C**
V	mm^2	mm	mm	mm	mm	MΩ·km	MΩ·km
300/500	3 × 1,5	0,6	1,5	8,9	11,6	9,4	0,0094
300/500	3 × 2,5	0,6	1,6	10,1	13,2	7,6	0,0076
450/750	3 × 1,5	0,7	1,5	9,2	11,8	10,5	0,0105
450/750	3 × 2,5	0,7	1,6	10,5	13,5	8,6	0,0086
450/750	3 × 4	0,7	1,7	12,1	15,5	7,1	0,0071
450/750	3 × 6	0,7	1,9	13,7	17,5	6,1	0,0061
450/750	3 × 10	0,7	2,1	16,3	20,8	4,9	0,0049
450/750	3 × 16	0,7	2,4	19,4	24,9	3,9	0,0039
450/750	3 × 25	0,9	2,8	24,2	30,9	3,9	0,0039
450/750	3 × 35	0,9	3,2	28,4	36,3	3,3	0,0033
450/750	4 × 2,5	0,7	1,7	11,6	14,9	8,6	0,0086
450/750	4 × 4	0,7	1,9	13,4	17,2	7,1	0,0071
450/750	4 × 6	0,7	2,0	15,2	19,4	6,1	0,0061
450/750	4 × 10	0,7	2,3	18,1	23,2	4,9	0,0049
450/750	4 × 16	0,7	2,6	21,7	27,7	3,9	0,0039
450/750	4 × 25	0,9	3,1	27,0	34,5	3,9	0,0039
450/750	4 × 35	0,9	3,5	31,7	40,6	3,3	0,0033
450/750	5 × 2,5	0,7	1,8	12,9	16,5	8,6	0,0086
450/750	5 × 4	0,7	2,0	14,9	19,1	7,1	0,0071
450/750	5 × 6	0,7	2,2	16,9	21,7	6,1	0,0061
450/750	5 × 10	0,7	2,5	20,3	25,9	4,9	0,0049
450/750	5 × 16	0,7	2,8	24,2	31,0	3,9	0,0039
450/750	5 × 25	0,9	3,4	30,2	38,7	3,9	0,0039
450/750	5 × 35	0,9	3,9	35,6	45,5	3,3	0,0033
表 4b 中的平均外形尺寸值是指具有一个或两个控制芯的结构。							

The overall dimensions of cables have been calculated in accordance with EN 60719.
根据 EN 60719 计算了电缆的外形尺寸。

EN 50620:2017 (E)

Table 5 — 完整电缆测试

1	2	3	4	5	6	7
Ref No	**Test**	**Unit**	**Category of test**	**Test method**	**Rated voltage of cables**	
					300/500 V	**450/750 V**
1	**Electrical test 电气试验**					
1.1	Measurement of the resistance of conductor 导体电阻的测量		T,S	EN 50395:2005, Clause 5		
1.1.1	Values to be obtained, max 要获得的值，最大值				see EN 60228	see EN 60228
1.2	Voltage test on cores 芯线电压试验		T,S	EN 50395:2005, Clause 7		
1.2.1	Test conditions:试验条件 - length of sample 样品长度	m			5	5
	- minimum period of immersion in water 最短浸泡时间	h			1	1
	- temperature of the water 水温	°C			20 ± 5	20 ± 5
1.2.2	Applied voltage (a.c.) according to specified thickness of insulation:根据规定的绝缘厚度施加电压（交流）					
	- up to and inc. 0,6 mm 小于等于 0.6 mm	V			1 500	2 000
	- exceeding 0,6 mm 超过 0.6 毫米	V			2 000	2 500
1.2.3	Duration of each application of voltage, minimum 每次施加电压的持续时间，最小值	mi			5	5
1.2.4	Result to be obt ained 要获得的结果				No breakdown	No breakdown
1.3	Voltage test on completed cable 完成电缆的电压测试		T,S	EN 50395:2005, Clause 6		
1.3.1	Test conditions:试验条件 - minimum length of the sample 样品最小长度	m			20	20
	- minimum period of immersion in water 最短浸泡时间	h			1	1
	- temperature of the water 水温	°			20 ± 5	20 ± 5
	Voltage applied (a.c.)施加电压（交流）					
1.3.2	Duration of each application of voltage, minimum 每次施加电压的持续时间，最小值	C			2 500	3 500
1.3.3	Result to be obtained 要获得的结果	V			15	15
1.3.4					No breakdown	No breakdown
1.4	Absence of faults on insulation 绝缘无故障		R	EN 62230		
1.4.1	Test conditions: Result to be obtained 试验条件：试验结果				see EN 62230	see EN 62230
1.4.2					No breakdown	No breakdown

1	2	3	4	5	6	7
Ref No	**Test**	**Unit**	**Category of test**	**Test method**	**Rated voltage of cables**	
					300/500 V	**450/750 V**
1.5	Check on absence of faults on insulation 检查绝缘无故障		R			
1.5.1	Voltage test 电压试验			EN 50395:2005, 10.3		
1.5.2	Test conditions:试验条件					
	Applied voltage (a.c.) according to specified thickness of insulation:根据规定的绝缘厚度施加的电压（交流）					
	- up to and inc. 0,6 mm 小于等于 0.6 mm	V			1 500	2 000
	- exceeding 0,6 mm 超过 0.6 毫米	V			2 000	2 500
1.5.3	Duration of each application of voltage, minimum 每次施加电压的持续时间，最小值	min			5	5
1.5.4	Result to be obtained 要获得的结果				No breakdown	No breakdown
1.6	Measurement of insulation resistance 绝缘电阻测量		T,S			
1.6.1	Cables at 20°C20°C 时的电缆			EN 50395:2005, 8.1		
	Test conditions:试验条件					
	- length of sample 样品长度	m			5	5
1.6.1.1	- minimum period of immersion in water 最短浸泡时间	h			2	2
	- temperature of the water 水温	°C			20	20
	Result to be obtained 要获得的结果	MΩ·km			min. as stated in Table 4a/b	min. as stated in Table 4a/b
1.6.2	Cables at 90°C 90°C 时的电缆			EN 50395: 2005, 8.1		
	Test conditions: 试验条件					
	- length of sample 样品长度	m			5	5
1.6.2.1	- minimum period of immersion in water 最短浸泡时间	h			2	2
	- temperature of the water 水温	°C			90	90
1.6.2.2	Result to be obtained 要获得的结果	MΩ·km			min. as stated in Table 4a/b	min. as stated in Table 4a/b
1.7	Surface resistance of sheath 护套表面电阻		T,S	EN 50395:2005, Clause 11		
	Test conditions:试验条件					
1.7.1	- voltage applied, d.c.施加电压，直流	V			100 to 500	100 to 500
	- duration of test 试验持续时间	min			1	1
	Result to be obtained 要获得的结果					
1.7.2		Ω			≥ 10^9	≥ 10^9

EN 50620:2017 (E)

1	2	3	4	5	6	7
Ref No	**Test**	**Unit**	**Category of test**	**Test method**	**Rated voltage of cables**	
					300/500 V	**450/750 V**
1.8 1.8.1 1.8.2	Capacity of CP core to all power cores.CP 核对所有电源核的容量 Test conditions:试验条件 - frequency 频率 - temperature of the water 水温 Result to be obtained 要获得的结果	 kHz °C pF/m	T	EN 50289–1-5:2001, 4.3.1	 1 60 ± 5 ≤ 150	 1 60 ± 5 ≤ 150
1.9 1.9.1	Long term resistance of power cores to d.c.电源线芯对直流电的长期电阻 Test conditions:试验条件 - length of sample 样品长度 - duration of test 试验持续时间 - temperature of the water 水温 - d.c. voltage applied 施加直流电压	 m h °C	T	EN 50395:2005, Clause 9	 5 240 80 ± 5 600	 5 240 80 ± 5 900
2 2.1 2.2 2.3 2.4 2.4.1 2.4.2	**Constructional and dimensional tests** 结构和尺寸试验 Checking of compliance with constructional provisions 检查是否符合施工规定 Measurement of thickness of insulation 绝缘厚度测量 Measurement of thickness of sheath 护套厚度测量 Measurement of overall dimensions 外形尺寸测量 - Mean value 平均值 - ovality 椭圆度	 mm %	 T, S T, S T, S T, S T, S	 Inspection and manual test EN 50396:2005, 4.1 EN 50396:2005, 4.2/4.3 EN 50396:2005, 4.4.1 EN 50396:2005, 4.4.2	 Clause 6 of this standard see Table 4a/4b see Table 4a/4b see Table 4a/4b 15 %	 Clause 6 of this standard see Table 4a/4b see Table 4a/4b see Table 4a/4b 15 %
3	**Insulation material test 绝缘材料试验**		T	this standard	Table 2	Table 2
4	**Sheath material test 护套材料试验**		T	this standard	Table 3	Table 3
5 5.1 5.2	**Resistance of sheath against N-oxalic acid 鞘层对 N-草酸的抗性** Test condition:试验条件 - temperature 温度 - duration 时间 Result to be obtained:要获得的结果 - tensile strength, variation 拉伸强度，变化 - elongation at break 断裂伸长	 °C h % %	T	EN 60811–404	 23 ± 5 168 max. ± 40 ≥ 100	 23 ± 5 168 max. ± 40 ≥ 100
6 6.1 6.2	**Resistance of sheath against N-sodium hydroxide 鞘层对氢氧化钠的抗性** Test condition:试验条件 - temperature 温度 - duration 持续时间 Result to be obtained:要获得的结果	 °C h	T	EN 60811–404	 23 ± 5 168	 23 ± 5 168

1	2	3	4	5	6	7
Ref No	**Test**	**Unit**	**Category of test**	**Test method**	**Rated voltage of cables**	
					300/500 V	**450/750 V**
	- tensile strength, variation 拉伸强度，变化 - elongation at break 断裂伸长	% %			max. ± 40 ≥ 100	max. ± 40 ≥ 100
7	**Compatibility test 相容性试验**		T	EN 60811–401	Annex A	Annex A
8 8.1	**Cold impact test at −40 ± 2 °C** -40±2°C 下的冷冲击试验 Result to be obtained 要获得的结果		T	Annex C	 no crack	 no crack
9 9.1 9.2	**Cold bend test 冷弯试验** **Diameter of cable ≤ 12,5 mm** 电缆直径≤12.5 mm Test conditions:试验条件 - temperature - duration of conditioning 调节持续时间 Result to be obtained 要获得的结果	 °C h	T	EN 60811–504	 -40 ± 2 16 no cracks	 -40 ± 2 16 no cracks
10	**Cold elongation test 冷伸长试验** **Diameter of cable > 12,5 mm** **电缆直径>12.5 mm**		T	EN 60811–504	Table 2/3	Table 2/3
11 11.1 11.1.1 11.2 11.2.1 11.3	**Ozone resistance at complete cable 完整电缆的耐臭氧性** Method A 方法 A Test conditions:试验条件 - temperature 温度 - duration 期间 - ozone concentration (by volume) 臭氧浓度（按体积） OR Method B 方法 B Test conditions:试验条件 - temperature 温度 - relative humidity 相对湿度 - duration 期间 - ozone concentration (by volume)臭氧浓度（按体积） Result to be obtained 要获得的结果	 °C h % °C % h % 	T	EN 60811–403 EN 50396:2005, 8.1.3	 25 ± 2 24 (250–300) × 10^{-4} 40 ± 2 55 ± 5 72 (200 ± 50) × 10^{-6} no cracks	 25 ± 2 24 (200–300) × 10^{-4} 40 ± 2 55 ± 5 72 (200 ± 50) × 10^{-6} no cracks

EN 50620:2017 (E)

1	2	3	4	5	6	7
Ref No	**Test**	**Unit**	**Category of test**	**Test method**	**Rated voltage of cables**	
					300/500 V	**450/750 V**
12 12.1	**Weathering/UV-resistance 耐候性/抗紫外线性** Result to be obtained 要获得的结果		T	Annex F	no cracks	no cracks
13 13.1 13.2	**Shrinkage test at complete cable 完整电缆的收缩试验** Test conditions:试验条件 - temperature 温度 - duration 持续时间 - length L of sample 样品长度 L Result to be obtained:要获得的结果 - shrinkage 收缩	 °C h mm %	T	EN 60811–503	 120 ± 5 1 500 ± 5 max. 3	 120 ± 5 1 500 ± 5 max. 3
14 14.1	**Test under fire conditions** 火灾条件下的试验 Result to be obtained 要获得的结果		T, S	EN 60332–1-2:2004/A1:2015	EN 60332–1-2:2004/A1:2015, Annex A	EN 60332–1-2:2004/A1:2015, Annex A
15 15.1	**Assessment of halogens for all non-metallic materials 所有非金属材料的卤素评估** Result to be obtained [a] 要获得的结果		T	EN 50525–1:2011, Annex B	requirements of EN 50525–1:2011, Annex B	requirements of EN 50525–1:2011, Annex B
16 16.1 16.1.1	**Mechanical strength of completed cable 成品电缆机械强度** Flexing test followed, after immersion in water, by a voltage test at 2 000 V on cores for cables up to 4 mm^2 浸泡在水中后，在小于等于 4 mm 2 的电缆芯上进行 2000 V 的电压试验。 - number of cycles 循环次数 Result to be obtained 要获得的结果		T	EN 50396:2005, 6.2	 30 000 no crack, no breakdown	 30 000 no crack, no breakdown
16.2 16.2.1	Cylic bending test followed, after immersion in water, by a voltage test at 2 000 V on cores for cables larger 4 mm^2 浸泡在水中后，在 2 000 V 电压下对 4 mm 2 以上电缆的芯线进行圆柱弯曲试验 - number of cycles 循环次数 Result to be obtained 要获得的结果			ISO 14572:2011, 7.3 [b]	 5 000 no crack, no breakdown	 5 000 no crack, no breakdown
17	**Resistance against chemicals 抗化学药品**		T	Annex D		

[a] requirement for conductivity max. 40 µS/mm 最大导电率要求为 40µs/mm

[b] other test criteria have to be agreed between manufacturer and customer 制造商和客户必须商定其他试验标准

Annex A
附件 A
(normative)
规范性的
Requirements for compatibility test
相容性

A.1 Conditions
条件

Test samples shall be aged for 7 days at (100 ± 2) °C.

试样应在（100±2）°C 下老化 7 天。

A.2 RequirementsA.2 要求

After ageing the insulation and the sheath shall pass the requirements of Table A.1.

老化后，绝缘和护套应符合表 A.1 的要求。

Table A.1 — Requirements
表 A.1-要求

Tests 测验		units 单位	Insulation 绝缘	Sheath 护套
Tensile strength 拉伸强度	– median, min.中位数，最小值 – variation [a], max.变化 a，最大值	N/mm^2 %	– ± 30	– –30 [b]
Elongation at break 断裂伸长	– median, min. – variation [a], max.	% %	– ± 30	– ± 30

[a] Variation: difference between the median value obtained after ageing and the median value obtained without ageing expressed as a percentage of the latter.

变化：老化后获得的中值与未老化的中值之间的差异，用后者的百分比表示。

[b] Positive tolerances are not limited.

正公差不受限制

Annex B
附件 B
(informative)
Guide to use (future amendment EN 50565)
使用指南（未来修订版 EN 50565）

(This annex is informative. It will be incorporated into EN 50565 series at the next revision)
本附件仅供参考。它将在下一次修订时纳入 EN 50565 系列。

Table B.1 — Constructional details and limiting conditions
结构细节和限制条件

	Units		
Constructional details 结构细节 Nominal voltage rating 额定电压 Number of power cores and cross- sectional area size range examples 电源线芯数量和横截面积尺寸范围示例	V mm^2	300/500 3 × 1,5 3 × 2,5	450/750 see Table 4a and 4b
Duty 责任 Extra light 额外照明 light 光 Ordinary 普通 Heavy 重的		+ + - -	+ + + +
Presence of water 水的存在 Condition AD1 条件 AD1 Condition AD2 Condition AD6 Condition AD7 Condition AD8		+ + + - -	+ + + - -
Corrosive or polluting substances 腐蚀性或污染性物质 condition AF3 条件 AF3		-	-
Impact condition AG2 冲击条件 ag2		-	+
Vibrations condition AH3 振动条件 AH3		-	+
Outdoor use 户外使用 Intermittent and temporary periods of short duration 短时间的间歇性和临时性周期 Permanent 永久的		+ -	+ +
Charging mode 充电模式 According to EN 61851–1 根据 EN 61851–1	Mode	1	1, 2, 3
Flexing 弯曲 Frequent flexing 频繁弯曲		+	+
Temperature 温度			
Maximum conductor operating temperature normal 导体最高工作温度正常	°C	90	
Maximum conductor operating temperature short circuit 最大导体工作温度短路 (Maximum allowable time 5 s). 最大允许时间 5 s	°C	200°C (tinned conductor) 160°C for EVI-1 250°C (bare or silver coated conductor) 200°C（镀锡导线） EVI-1 为 160°C 250°C（裸导线或镀银导线）	
Maximum cable surface temperature 最大电缆表面温度 （操作这些电缆时应避免皮肤接触，除非计算表明表面温度不超过 50° C）	°C	80 (Skin contact should be avoided when operating these cables unless calculations show that the surface temperature does not exceed 50°C)	
Maximum storage temperature 最高储存温度	°C	40	
Minimum installation and handling temperature 最低安装和搬运温度	°C	−35	

Annex C 附件 C
(normative)（规范性附录）
Cold impact test
低温冲击试验

The cold impact test shall be performed at –(40 ± 2) °C according to EN 60811-506, but the mass of hammer, the mass of steel intermediate piece and height shall comply with Table C.1.
根据 EN 60811-506，低温冲击试验应在–（40±2）°C 下进行，但锤的质量、钢中间件的质量和高度应符合表 C.1 的要求。

Table C.1 — Parameter for cold impact
冷冲击参数

Cable diameter (D) mm	Mass of hammer 锤的质量 g	Mass of steel intermediate piece 钢中间件质量 g	Height mm
D ≤ 15	1000	200	100
15 < D ≤ 25	1500	200	150
D > 25	2000	200	200

The cable shall be inspected with normal or corrective vision without magnification. No cracks shall be determined.
应在不放大的情况下用正常或矫正视力检查电缆。不应确定任何裂缝。

Annex D
附录 D
(normative)
规范性附录
Resistance against chemicals
抗化学药品

Table D.1 — List of test media
测试介质列表

	Test-medium 试验介质
1	Lubricating oil engine severe duty Diesel and gasoline service (15W40)润滑油发动机重型柴油和汽油服务（15W40）
2	Gasoline automotive unleaded; EN 228 汽车用无铅汽油；EN 228
3	Urea solution (32,5 %) in acc. with ISO 22241-1 符合 ISO 22241-1 的尿素溶液（32.5%）
4	Diesel fuel, automotive EN 590 柴油，汽车 EN 590
5	Anti freezing agent, Ethylenglycol ($C_2H_6O_2$) – water (mixing 1:1)防冻剂，乙二醇（c2h6o2）–水（混合 1:1）
6	Solvent cleansing compound, for example: P3-Solvclean AK (Fa. Henkel); 溶剂清洗化合物，例如：P3 SolvClean AK（FA.汉高）

Requirements for resistance against chemicals
耐化学品要求

The completed cable shall be immersed for 1 h at room temperature in each of the test chemicals. Cable ends shall not be immersed in fluid. The cable can be slightly bent to fit into test container with fluid.

完成的电缆应在室温下浸入每个试验化学品中 1 h。电缆端头不得浸入液体中。可以稍微弯曲电缆，以便将液体装入测试容器中。

The testing shall be done after 22 h after immersion. The cable shall be bent around a mandrel with a diameter equal to 5 times the outer diameter of the cable. The test cable shall show no crack when examined with normal or corrected vision without magnification.

试验应在浸泡 22 小时后进行。电缆应绕着直径等于电缆外径 5 倍的芯轴弯曲。在无放大的情况下，用正常或校正视力检查时，测试电缆应无裂纹。

Annex E
附件 E
(informative)
（信息性）
Current ratings
电流额定值

The current ratings given in this annex are for ordinary and heavy duty flexible cables (copper conductors), for cables in free air or cables touching a surface with an ambient temperature of 30 °C. The values given for the cables, are based on continuously loaded cable (100 % load factor) with current having an alternating frequency of 50 or 60 Hz. National regulations/codes also give current carrying capacity that are in line with limiting temperatures of the cables.

本附录中给出的电流额定值适用于普通和重型软电缆（铜导线），适用于自由空气中的电缆或与环境温度为 30° C 的表面接触的电缆。给出的电缆值基于连续加载的电缆（100%负载系数），其中铜交流频率为 50 或 60 赫兹的电流。国家法规/规范也给出了符合电缆极限温度的载流能力。

Table E.1 — Current rating for flexible cable for Mode 1 charging only (300/500 V)
仅用于模式 1 充电的软电缆的额定电流（300/500 V）

Conductor cross-section (mm^2) 导线截面（mm2）	Current rating (A)额定电流（A）
	Single phase 单相
1,5	14
2,5	25
NOTE Current rating also suitable for cables touching a surface. 注：额定电流也适用于接触表面的电缆。	

Table E.2 — Current rating for flexible cable for Mode 2 and 3 charging (450/750V)

Conductor cross-section (mm2)	Current rating (A)	
	Single phase	Three phase 三相
1,5	14	-
2,5	25	20
4	35	30
6	44	38
10	62	54
16	82	71
25	109	94
35	135	117
NOTE 1 Conductor temperature 60 °C, which takes into account that the surface of the cable should not exceed 50 °C, to avoid involuntary reaction in the event of contact with exposed skin.注 1：导线温度为 60° C，考虑到电缆表面不应超过 50° C，以避免与暴露的皮肤接触时发生非自愿反应。 NOTE 2 The tabulated ratings are for cable run in free air 注 2：表中的额定值适用于自由空气中的电缆敷设。		

Temperature correction factors 温度修正系数						
Ambient temperature °C 环境温度 °C	30	35	40	45	50	55
Correction factor 修正系数	1,0	0,91	0,82	0,71	0,58	0,41

The selection of the cross-sectional area of the power conductor shall not be based on current-carrying capacity alone. Account shall also be taken of for instance the voltage drop, which is related to the efficiency of the charging process.

电力导体的横截面积的选择不应仅基于载流能力。还应考虑电压降，这与充电过程的效率有关。

Annex F
附件 F
(normative)
规范性的
Weathering/UV resistance test
耐候性/抗紫外线试验

This test is to determine the UV stability of the sheathing material of the cable. This is done by assessment of cracks after exposure to ultraviolet light and water.

本试验旨在确定电缆护套材料的紫外线稳定性。这是通过评估暴露在紫外线和水下后的裂缝来完成的。

The samples shall be pieces of a completed cable.

样品应为完整电缆的碎片。

Two samples shall be exposed to UV light in accordance with the requirements of EN 50289-4-17 Method A, for 720 h (360 cycles).

应按照 EN 50289-4-17 方法 A 的要求，将两个样品暴露在紫外线下 720 h（360 次循环）。

NOTE Additional information on weathering/UV resistance testing can be found in EN ISO 4892-1:2016, and EN ISO 4892-2:2013.注：有关耐候性/抗紫外线试验的更多信息，请参见 EN ISO 4892-1:2016 和 EN ISO 4892-2:2013。

After the exposure, the test specimens shall be removed from the equipment and conditioned at ambient temperature for at least 16 h. Then the cable shall be bent around a mandrel with a diameter equal to 5 times the outer diameter of the cable.

暴露后，应将试样从设备上取下，并在环境温度下至少调节 16 h。然后，电缆应围绕直径等于电缆外径 5 倍的芯轴弯曲。

After the bending the sheath of both samples shall show no crack when examined with normal or corrected vision without magnification.

弯曲后，两个样品的护套在无放大的情况下用正常或校正视力检查时不得出现裂纹。

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