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Cycles — Safety requirements for bicycles —

Part 10:
Safety requirements for electrically power assisted cycles (EPACs)

Cycles — Exigences de sécurité relatives aux bicyclettes —

Partie 10: Exigences de sécurité des cycles à assistance électrique (EPAC)

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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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 149/SC 1.

ISO 4210-10 was prepared by Technical Committee ISO/TC 149, *Cycles*, Subcommittee SC 1, *Cycles and major sub-assemblies*.

ISO 4210 consists of the following parts, under the general title *Cycles — Safety requirements for bicycles*:

— *Part 1: Terms and definitions*

— *Part 2: Requirements for city and trekking, young adult, mountain and racing bicycles*

— *Part 3: Common test methods*

— *Part 4: Braking test methods*

— *Part 5: Steering test methods*

— *Part 6: Frame and fork test methods*

— *Part 7: Wheel and rim test methods*

203 — *Part 8: Pedal and drive system test methods*

204 — *Part 9: Saddle and seat-post test methods*

205 — *Part 10: Safety requirements for electrically power assisted cycles (EPACs)*

Introduction

This International Standard combines several countries' safety requirements for Electrically Power Assisted Cycles (EPACs). The commercialization of EPACs has accelerated in the global market, in response to global concerns about CO_2 reduction and energy saving. EPAC technologies for performance, electrical control, battery management and battery charging are currently developing rapidly in a competitive market. It is therefore necessary to standardize the safety of these technologies for EPACs.

This standardization will allow an easy and clear understanding of requirements for different types of EPAC.

This International Standard includes safety requirements for the charging of EPACs. This includes off-board parts and EPAC battery chargers.

This international standard does not state the limit for the maximum permissible load of the EPAC. The manufacturer is advised to consider amongst other factors the maximum permissible load (luggage plus rider) as well as the intended use of the EPAC. Both have an influence on the mechanical requirements.

Users of the International Standard are invited to provide their feedback to ISO/TC 149/SC 1.

Cycles — Safety requirements for bicycles — Part 10: Safety requirements for electrically power assisted cycles (EPACs)

1 Scope

This International Standard specifies safety and performance requirements for the design, marking, assembly, and testing of two wheeled electrically power assisted cycles (hereafter EPACs), fully-assembled EPACs and subassemblies, and provides guidelines for information supplied by the manufacturers (i.e. instructions on the use and care of such EPACs).

This International Standard applies to two wheeled EPACs that have a maximum saddle height of 635 mm or more and are intended for private and commercial use with exception of EPACs intended for hire from unattended stations.

This International Standard is intended to cover all common significant hazards, hazardous situations and events listed in 5.3 of EPACs, when used as intended or under conditions of misuse that are reasonably foreseeable by the manufacturer.

This International Standard specifies requirements and test methods for engine power management systems, electrical circuits including the charger for the assessment of the design and assembly of EPACs and sub-assemblies for systems having a Safety Extra Low Voltage (SELV) maximum voltage up to 60 V d.c. including tolerances.

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 178:2010, *Plastics — Determination of flexural properties*

ISO 179-1:2010, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test*

ISO 2409:2013, *Paints and varnishes — Cross-cut test*

ISO 2575:2010, *Road vehicles — Symbols for controls, indicators and tell-tales*

ISO 4210-1, *Cycles — Safety requirements for bicycles — Part 1: Terms and definitions*

ISO 4210-2, *Cycles — Safety requirements for bicycles — Part 2: Requirements for city and trekking, young adult, mountain and racing bicycles*

ISO 4210-4, *Cycles — Safety requirements for bicycles — Part 4: Braking test methods*

ISO 4210-5, *Cycles — Safety requirements for bicycles — Part 5: Steering test methods*

ISO 4210-6, *Cycles — Safety requirements for bicycles — Part 6: Frame and fork test methods*

ISO 4210-9, *Cycles — Safety requirements for bicycles — Part 9: Saddle and seat-post test methods*

ISO 4892-2:2013, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 11451-1:2015, *Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 1: General principles and terminology*

ISO 11451-2:2015, *Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 2: Off-vehicle radiation sources*

ISO11452-1:2015, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 1: General principles and terminology*

ISO 11452-2:2004, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 2: Absorber-lined shielded enclosure*

ISO11452-4:2011, *Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 4: Harness excitation methods*

ISO 11898-1:2015, *Road vehicles — Controller area network (CAN) —Part 1: Data link layer and physical signalling*

ISO 11898-2, *Road vehicles — Controller area network (CAN) —Part 2: High-speed medium access unit*

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13849-2, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*

IEC 60034-1, *Rotating electrical machines — Part 1: Rating and performance*

IEC 60068-2-27, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

IEC 60335-1:2010, *Household and similar electrical appliances — Safety — Part 1: General requirements*

IEC 60335-2-29, *Household and similar electrical appliances — Safety — Part 2-29: Particular requirements for battery chargers*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 62133-1:2017, *Secondary cells and batteries containing alkaline or other non-acid electrolytes — Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications —- Part 1: Nickel systems*

IEC 62133-2:2017, *Secondary cells and batteries containing alkaline or other non-acid electrolytes — Safety requirements for portable sealed secondary lithium cells, and for batteries made from them, for use in portable applications — Part 2: Lithium systems*

CISPR 12:2007+A1:2009, *Vehicles, boats and internal combustion engines — Radio disturbance characteristics — Limits and methods of measurement for the protection of off-board receivers*

CISPR 16-1-1:2015, *Specification for radio disturbance and immunity measuring apparatus and methods — Part 1-1: Radio disturbance and immunity measuring apparatus — Measuring apparatus*

CISPR 25:2016, *Vehicles, boats and internal combustion engines — Radio disturbance characteristics — Limits and methods of measurement for the protection of on-board receivers*

EN 50604-1:2016, *Secondary lithium batteries for light EV (electric vehicle) applications — Part 1: General safety requirements and test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4210-1 and the following 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

3.1
cycle
any vehicle which has at least two wheels and is propelled by the muscular energy of the person on that vehicle, in particular by means of pedalling or the possibility of adding assistance provided by electric motor when pedalling

Note 1 to entry: Pedalling also refers to use of hand cranks or other similar devices.

3.2
electrically power assisted cycle
EPAC
cycle, equipped with pedals and an auxiliary electric motor, which cannot be propelled exclusively by means of this auxiliary electric motor, except in the walk assistance mode

3.3
mountain EPAC
electrically power assisted cycle designed for use off-road on rough terrain, on public roads, and on public pathways, equipped with a suitably strengthened frame and other components, and, typically, with wide-section tyres with coarse tread patterns and a wide range of transmission gears

[SOURCE: ISO4210-1:2014, 2.30, modified — bicycle has been changed to electrically power assisted cycle.]

3.4
braking device cut-off switch
device that cuts off the motor assistance while braking

3.5
continuous rated power
output power specified by manufacturer, at which the motor reaches its thermal equilibrium at given ambient conditions

3.6
assisted rate
ratio of between mechanical motor output-power and muscular human input-power

3.7
thermal equilibrium
temperatures of motor parts which do not vary more than 2 °C/h

3.8
assistance cut-off speed
speed at which the motor controller cuts off the assistance of the auxiliary electric motor

3.9
walk assistance mode
function by which the user can activate the auxiliary electric motor to propel the EPAC up to a defined maximum speed without pedalling

3.10
electromagnetic compatibility
ability of an EPAC or one of its electrical/electronic systems to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbance to anything in that environment

[SOURCE: IEC 60050-161:1990/AMD8:2018, IEV ref 161-01-07, modified — an EPAC or one of its electrical/electronic systems have been specified.]

3.11
electromagnetic disturbance
electromagnetic phenomena such as electromagnetic noise, an unwanted signal or a change in the propagation medium itself which may degrade the performance of an EPAC or one of its electronic/electrical systems

3.12
electromagnetic environment
all electromagnetic phenomena present in a given situation

3.13
electromagnetic immunity
ability of an EPAC or one of its electronic/electrical systems to perform without degradation of its performance in the presence of specific electromagnetic disturbance

3.14
ESA
electronic/electrical subassembly
electronic and/or electrical component, or an assembly of components provided for installation into an EPAC, together with all electrical connections and associated wiring for the execution of several specific functions

3.15
ESA test
test carried out on one or more specific ESAs

3.16
motor controller
device or group of devices that serves to govern in some predetermined manner the performance of an electric motor

Note 1 to entry: Means for manual or automatic ON/OFF, selecting the drive direction, regulating the speed, limiting the torque and providing protection against faults.

3.17
fault condition
condition in which one or more fault is present which could cause hazard

3.18
charging configuration
sets of physical parameters which are predefined to control a charging process

3.19
battery management system
BMS
local energy management system for the battery system, protecting the battery system from damage, monitoring and increasing the lifetime, and maintaining the functional state

Note 1 to entry: BMS and BCU (according to ISO 12405) do not have the same functions

3.20
narrow-band emission
emission which has a bandwidth less than that of a specific receiver or measuring instrument

3.21
no load current point
current measured at battery output with no change to the operating status of any auxiliary systems during the test

3.22
safety extra-low voltage (SELV)
voltage not exceeding ripple-free 60 V d.c. between conductors and earth, the no load voltage not exceeding ripple-free 60 V d.c.

3.23
anti-tampering measures
technical requirements and specifications which prevent, as far as possible, unauthorized modifications of the EPAC's drive system which may prejudice functional safety

3.24
maximum permissible load
maximum permissible weight of rider and luggage as defined by the manufacturer