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Electrically propelled mopeds and motorcycles — Safety specifications

Cyclomoteurs et motocycles à propulsion électrique — Spécifications de sécurité

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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 13063 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 23, *Mopeds*.

Electrically propelled mopeds and motorcycles — Safety specifications

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1 Scope

This International Standard specifies requirements for functional safety means, protection against electric shock and the on-board rechargeable energy storage systems intended for the propulsion of any kind of electrically propelled mopeds and motorcycles when used in normal conditions.

It is applicable only if maximum working voltage of the on-board electrical circuit does not exceed 1000 V a.c. or 1500 V d.c.

This International Standard does not provide comprehensive safety information for manufacturing, maintenance and repair personnel.

2 Normative references

The following referenced documents are indispensable for the application 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 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 6469-3, *Electrically propelled road vehicles — Safety specifications — Part 3: Protection of persons against electric shock*

ISO 20653, *Road vehicles — Degrees of protection (IP-code) — Protection of electrical equipment against foreign objects, water and access*

IEC 60227-1, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 1: General requirements*

IEC 60245-1, *Rubber insulated cables — Rated voltages up to and including 450/750 V — Part 1: General requirements*

IEC 60479-1:2005, *Effects of current on human beings and livestock — Part 1: General aspects*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests*

IEC 60950-1, *Information technology equipment — Safety — Part 1: General requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
auxiliary electric system
on-board vehicle system, other than for vehicle propulsion, which operates on electric energy

3.2
balance of electric power system
remaining portion of an electric power system when the power sources (e.g. fuel cell stacks, batteries) are disconnected

3.3
barrier
part providing protection against direct contact from any usual direction of access

3.4
basic insulation
insulation applied to live parts for protection against direct contact under fault-free conditions

NOTE Basic insulation does not necessarily include isolations used exclusively for functional purposes.

3.5
basic protection
protection against direct contact with live parts under fault-free conditions

3.6
battery-electric vehicle
BEV
electric vehicle with only a traction battery as the power source for vehicle propulsion

NOTE The abbreviation BEV is often shortened to EV.

3.7
battery pack
single mechanical assembly comprising battery cells and retaining frames or trays and possibly components for battery management

3.8
BEV operating mode
in operating mode of an HEV, in which only the RESS is used for energy supply for vehicle propulsion and possibly auxiliary electric systems

3.9
conductive part
conductor
part capable of conducting electric current

3.10
creepage distance
shortest distance along a surface of a solid insulating material between two conductive parts

3.11
direct contact
contact of persons with live parts

3.12
double insulation
insulation system comprising both basic insulation and supplementary insulation

3.13
drive direction control
device physically actuated by the rider for selecting the driving direction of the road vehicle (forward or backward)

EXAMPLE Lever or push-button switch.

3.14
driving-enabled mode
only operating mode in which the vehicle can be moved by its own propulsion system

3.15
electric chassis
conductive parts of a vehicle that are electrically connected and whose potential is taken as reference

3.16
electric drive
combination of an electric motor and associated power electronics for the conversion of electric to mechanical power and vice versa

3.17
electric power system
electric circuit, containing electric power sources (e.g. fuel cell stacks, batteries)

3.18
electric shock
physiological effect resulting from an electric current passing through a human body

3.19
electrically propelled vehicle
EPV
vehicle with one or more electric drive(s) for vehicle propulsion

3.20
enclosure
part providing protection of equipment against direct contact from any direction

3.21
exposed conductive part
conductive part of the electric equipment that can be touched by a test finger according to IPXXB after removing barriers/enclosures that can be removed without using tools and that is not normally live, but which may become live under fault conditions

NOTE Protection degrees (e.g. IPXXB) are defined in ISO 20653.

3.22
hybrid electric vehicle
HEV
vehicle with at least one RESS and one fuelled power source for vehicle propulsion

EXAMPLE ICE or fuel-cell systems are typically types of fuelled power sources.

3.23
isolation-resistance monitoring system
system which periodically or continuously monitors the isolation resistance between live parts and the electric chassis or exposed conductive parts

3.24
isolation resistance
resistance between live parts of voltage class B electric circuit and the electric chassis or exposed conductive parts as well as the voltage class A system

3.25
live part
conductor or conductive part intended to be electrically energized in normal use

3.26
maximum working voltage
highest value of a.c. voltage (rms) or of d.c. voltage which may occur in an electric system under any normal operating conditions according to manufacturers' specifications, disregarding transients

3.27
potential equalization
electric connections of exposed conductive parts of the electric equipment to minimize differences in potential between these parts

3.28
protection degree
protection provided by a barrier/enclosure related to the contact with live parts by a test probe, such as a test finger (IPXXB), a test rod (IPXXC), or a test wire (IPXXD)

NOTE Protection degrees (e.g. IPXXB, IPXXC or IPXXD) are defined in ISO 20653.

3.29
rechargeable energy storage system
RESS
system that stores energy for delivery of electric energy and which is rechargeable

EXAMPLE Batteries, capacitors.

3.30
reinforced insulation
insulation of live parts for protection against electric shock equivalent to double insulation

NOTE Reinforced insulation does not imply that the insulation shall be a homogeneous piece. The reinforced insulation may comprise several layers which cannot be tested individually as supplementary or basic insulation.

3.31
supplementary insulation
independent insulation applied in addition to basic insulation for protection against electric shock in the event of a failure of the basic insulation

3.32
traction battery
propulsion battery
battery
collection of all battery packs, which are electrically connected, for the supply of electric power to the electric drive and conductively connected auxiliary system, if any

3.33
voltage class A
classification of an electric component or circuit as belonging to voltage class A, if its maximum working voltage is ≤ 30 V a.c. or ≤ 60 V d.c., respectively

3.34
voltage class B
classification of an electric component or circuit as belonging to voltage class B, if its maximum working voltage is (> 30 and ≤ 1000) V a.c. or (> 60 and ≤ 1500) V d.c., respectively

3.35
wiring
a system of wires providing electric circuits and including cables and connectors

4 Environmental and operational conditions

The requirements given in this International Standard shall be met across the range of environmental and operational conditions for which the electrically propelled vehicle is designed to operate, as specified by the vehicle manufacturer.

NOTE See ISO 16750 for guidance.

5 Voltage classes

Depending on its maximum working voltage *U*, an electric component or circuit belongs to one of the voltage classes specified in Table 1.

Table 1 — Voltage classes

Dimensions in volts

Voltage class	Maximum working voltage	
	d.c.	a.c.
A	0 < U ≤ 60	0 < U ≤ 30
B	60 < U ≤ 1500	30 < U ≤ 1000
NOTE The values 60 V d.c. and 30 V a.c. are selected taking into account humid weather conditions.		

6 Marking

6.1 Marking of voltage class B electric components

The symbol shown in Figure 1 shall appear on (preferably) or near voltage class B electric energy storage systems as RESS and fuel cell stacks. The same symbol shall be visible on barriers and enclosures, which, when removed expose live parts of voltage class B circuits. Accessibility and removability of barriers/enclosures should be considered for the necessity of the symbol. The symbol background shall be yellow, the bordering and the arrow shall be black in accordance with ISO 3864-1.

Figure 1 — Symbol of voltage class B electric components

6.2 Marking of voltage class B wiring

The outer covering of cables and harness for voltage class B circuits, not within enclosures or behind barriers shall be marked with orange colour.

NOTE 1 Voltage class B connectors can be identified by the harnesses to which the connector is attached.

NOTE 2 Specifications of orange colour are given, e.g., in standards in the US (8.75R5.75/12.5) and in Japan (8.8R5.8/12.5), according to the Munsell colour system.

7 Requirements and measures of voltage class A electric components

7.1 Requirements of voltage class A electric components

7.1.1 General requirements of voltage class A electric components

The electrical control system shall be designed so that, should it malfunction in a hazardous manner, it shall switch off power to the electric motor.

Safety and compatibility of the combination between RESS and any auxiliary electric energy supplies shall be ensured, according to the manufacturer's specifications.

7.1.2 General requirements of barrier/enclosures of voltage class A electric components

If protection may be provided by barriers/enclosures, live parts may be placed inside enclosures or behind barriers, preventing access to the live parts from any usual direction of access.

The barriers/enclosures provide sufficient mechanical resistance under normal operating conditions, as specified by the manufacturer.

7.1.3 Requirements of voltage class A electric cables and connections

Cable and plug temperature shall be lower than that specified by the manufacturer of the cables and plugs. There shall be no corrosion on plug pins and no damage to cable and plug insulation.

Compliance shall be checked by the test described in 7.2.1.

7.1.4 Requirements of voltage class A wiring

The following provisions apply to voltage class A wiring:

a) Wire ways shall be smooth and free from sharp edges.

b) Wires shall be protected so that they do not come into contact with burrs, cooling fins or similar sharp edges that may cause damage to their insulation. Holes in metal through which insulated wires pass shall have smooth well-rounded surfaces or be provided with bushings.

c) Wiring shall be effectively prevented from coming into contact with moving parts.

Separate parts of the RESS that can move in normal use or during user maintenance relative to each other, shall not cause undue stress to electrical connections and internal conductors, including those providing earthing continuity.

Compliance with a), b), c) shall be checked by inspection.

d) If an open coil spring is used, it shall be correctly installed and insulated. Flexible metallic tubes shall not cause damage to the insulation of the conductors contained within them.

Compliance with d) shall be checked by inspection. If flexing occurs in normal use, the appliance is placed in its normal operational position and is supplied at rated voltage under normal operation.

e) The movable part is moved backwards and forwards, so that the conductor is flexed through the largest angle permitted by its construction.

Compliance with e) shall be checked by the test described in 7.2.2.

f) The insulation of internal wiring shall withstand the electrical stress likely to occur in normal use.

Compliance with f) shall be checked by the test described in 7.2.2. The wiring shall not reduce the basic insulation adopted by the manufacturer or the basic insulation shall be electrically equivalent to the basic insulation of cords complying with IEC 60227-1 or IEC 60245-1.

