INTERNATIONAL STANDARD

ISO 13232-1

Second edition
2005-12-15

Motorcycles — Test and analysis procedures for research evaluation of rider crash protective devices fitted to motorcycles —

Part 1: Definitions, symbols and general considerations

Motocycles — Méthodes d'essai et d'analyse de l'évaluation par la recherche des dispositifs, montés sur les motocycles, visant à la protection des motocyclistes contre les collisions —
Partie 1: Définitions, symboles et généralités

Reference number
ISO 13232-1:2005(E)

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

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.

ISO 13232-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 22, *Motorcycles*.

This second edition cancels and replaces the first version (ISO 13232-1:1996), which has been technically revised.

ISO 13232 consists of the following parts, under the general title *Motorcycles — Test and analysis procedures for research evaluation of rider crash protective devices fitted to motorcycles*:

— *Part 1: Definitions, symbols and general considerations*

— *Part 2: Definition of impact conditions in relation to accident data*

— *Part 3: Motorcyclist anthropometric impact dummy*

— *Part 4: Variables to be measured, instrumentation and measurement procedures*

— *Part 5: Injury indices and risk/benefit analysis*

— *Part 6: Full-scale impact-test procedures*

— *Part 7: Standardized procedures for performing computer simulations of motorcycle impact tests*

— *Part 8: Documentation and reports*

Introduction

ISO 13232 has been prepared on the basis of existing technology. Its purpose is to define common research methods and a means for making an overall evaluation of the effect that devices which are fitted to motorcycles and intended for the crash protection of riders, have on injuries, when assessed over a range of impact conditions which are based on accident data.

It is intended that all of the methods and recommendations contained in ISO 13232 should be used in all basic feasibility research. However, researchers should also consider variations in the specified conditions (for example, rider size) when evaluating the overall feasibility of any protective device. In addition, researchers may wish to vary or extend elements of the methodology in order to research issues which are of particular interest to them. In all such cases which go beyond the basic research, if reference is to be made to ISO 13232, a clear explanation of how the used procedures differ from the basic methodology should be provided.

ISO 13232 was prepared by ISO/TC 22/SC 22 at the request of the United Nations Economic Commission for Europe Group for Road Vehicle General Safety (UN/ECE/TRANS/SCI/WP29/GRSG), based on original working documents submitted by the International Motorcycle Manufacturers Association (IMMA), and comprising eight interrelated parts.

This revision of ISO 13232 incorporates extensive technical amendments throughout all the parts, resulting from extensive experience with the standard and the development of improved research methods.

In order to apply ISO 13232 properly, it is strongly recommended that all eight parts be used together, particularly if the results are to be published.

Motorcycles — Test and analysis procedures for research evaluation of rider crash protective devices fitted to motorcycles —

Part 1: Definitions, symbols and general considerations

1 Scope

This part of ISO 13232 provides the definitions, abbreviations, symbols and other general considerations used in all parts of ISO 13232, which specifies the minimum requirements for research into the feasibility of protective devices fitted to motorcycles, which are intended to protect the rider in the event of a collision.

ISO 13232 is applicable to impact tests involving:

— two-wheeled motorcycles;

— the specified type of opposing vehicle;

— either a stationary and a moving vehicle or two moving vehicles;

— for any moving vehicle, a steady speed and straight-line motion immediately prior to impact;

— one helmeted dummy in a normal seating position on an upright motorcycle;

— the measurement of the potential for specified types of injury by body region;

— evaluation of the results of paired impact tests (i.e. comparisons between motorcycles fitted and not fitted with the proposed devices).

ISO 13232 does not apply to testing for regulatory or legislative purposes.

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 13232-2, *Motorcycles — Test and analysis procedures for research evaluation of rider crash protective devices fitted to motorcycles — Part 2: Definition of impact conditions in relation to accident data*

AIS-90:1990, Association for the Advancement of Automotive Medicine (AAAM) Des Plaines, IL, USA *The abbreviated injury scale, 1990 revision*

UN/ECE/TRANS/WP.29/78/Rev 1/Amend.2: 1999, *The consolidated resolution on the construction of vehicles (R E 3), Rev 1*

3 Terms and definitions

3.1 General terms

3.1.1
motorcycle
MC
two-wheeled vehicle with an engine cylinder capacity in the case of a thermic engine exceeding 50 cm^3 or whatever the means of propulsion a maximum design speed exceeding 50 km/h

[Adapted from UN/ECE/TRANS/WP.29/78/Rev 1/Amend.2: 1999]

3.1.2
opposing vehicle
OV
saloon type passenger car, into which the MC is impacted

3.1.3
leg protective device
device which is intended to reduce the frequency of leg bone fractures

3.1.4
structural element of the MC
any substantially rigid component of the MC

EXAMPLE forks, brake assembly, frame

3.1.5
head protective device
device which is intended to reduce the frequency or severity of head concussive injuries

3.1.6
fitted to the motorcycle
attached in a permanent manner to a structural element of the motorcycle

3.1.7
crash protection
reduction of the frequency or severity of rider injuries during impacts

3.1.8
rider
operator of a motorcycle

3.1.9
baseline MC
MC which has not been fitted with a protective device

3.1.10
modified MC
MC which has been fitted with a protective device

3.1.11
paired comparison
testing and comparing results between two or more identical MCs with the only experimental variable between or among them being the presence of the proposed protective device

3.1.11.1
single paired comparison
paired comparison which includes only one test with a modified MC and only one test with a baseline MC

3.1.11.2
multiple paired comparison
paired comparison which includes more than one test with modified MCs, all with the same modification, and an equal number of tests with baseline MCs

3.1.11.3
group of tests
all of the tests with the baseline MC and with the modified MC, in a paired comparison which involves more than two tests

3.1.12
impact conditions
impact variables
five variables which characterize and define the positions, orientations and velocities of the MC and OV immediately prior to impact in a full-scale impact test, a computer simulation of an impact, or in MC/OV accident data

3.1.12.1
relative heading angle
rha
angle between the MC x axis and the OV x axis measured in a clockwise direction from the MC x axis as viewed from above, immediately prior to first MC/OV contact

3.1.12.2
OV impact speed
OVS
magnitude of the OV velocity relative to the ground, immediately prior to first MC/OV contact

3.1.12.3
MC impact speed
MCS
magnitude of the MC velocity relative to the ground, immediately prior to first MC/OV contact

3.1.12.4
OV contact point (for full-scale tests or computer simulations)
OVCP
target or measured point on the periphery of the OV, when viewed from above

[see ISO 13232-2]

3.1.12.5
OV contact point
for accident analysis, point representing the region of main and presumably initial structural damage to the OV in a given accident with an MC

3.1.12.6
MC contact point
MCCP
for full-scale tests or computer simulations, target point on the MC for the main impact with the OV, being the foremost point, the rearmost point or the midpoint along the MC overall length

3.1.12.7
MC contact point
for accident analysis, point representing the region of main and presumably initial structural damage to the MC in a given accident with a passenger car

3.1.13
first MC/OV contact
first instant in time when a part of the MC or the dummy contacts the OV

3.1.14
time of first MC/OV contact
time zero (for film analysis)
first frame on the high speed film which shows contact between a part of the MC or the dummy and the OV, or the frame immediately before where the first light emission from a contact sensing system occurs, whichever is sooner

3.1.15
time of first MC/OV contact
for electronic data, instant of initial contact between a part of the MC or the dummy and the OV, sensed by a contact switch and indicated by an electronic pulse on one of the data channels

3.1.16
first helmet/OV contact
first frame on the high speed film which shows contact between the helmet and the OV

3.1.17
primary impact period
time period from 0,050 s before first MC/OV contact until 0,500 s after first MC/OV contact

3.1.18
secondary impact period
time period from 0,500 s until 3,000 s after first MC/OV contact

3.1.19
entire impact sequence
time period from 0,050 s before until 3,000 s after first MC/OV contact

3.1.20 axis systems

3.1.20.1
vehicle axis system
mutually perpendicular set of three axes fixed in the plane of symmetry of the vehicle, with the x axis in the direction of forward straight line motion, the z axis downward parallel to gravity, and the y axis directed toward the right side of the vehicle

3.1.20.2
specimen axis system
mutually perpendicular set of three axes fixed in the specimen, with the axial axis parallel to the axis of symmetry or longest dimension of the specimen

3.1.20.3
inertial axis system
mutually perpendicular set of three axes fixed to the ground, with the x axis parallel to the pre-impact path of the MC, the z axis downward parallel to gravity, and the y axis to the right of the pre-impact path of the MC

3.1.20.4
head axis system
mutually perpendicular set of three axes fixed to the head, with x axis forward and horizontal in the mid-sagittal plane, the z axis downward in the mid-sagittal plane, and the y axis toward the right side of the head, and with the origin located at the Hybrid III head centre of gravity

3.1.20.5
dummy axis system
mutually perpendicular set of three axes fixed in each component of the dummy, with the x axis in the forward (anterior) direction, the y axis toward the right side of the dummy, and the z axis in the downward direction, and, in

general, passing through any joint axes present in the component, when the dummy is in a standing position, with hands and arms at the dummy sides, elbow pivot axes in the forward direction, palms toward the rear (posterior) of the dummy, knee pivot axes in the lateral direction, and toes in the forward direction

3.1.21
feasibility
capacity of a proposed protective device to reduce injuries to a given body region, and to reduce injury costs, in a significant percentage of the accident population, without increasing injury costs in more than a very small percentage of the accident population

[see ISO 13232-5]

3.1.22
failure mode and effects analysis
FMEA
objective identification of those impact configurations from the accident population in which a given protective device is predicted to cause increased injuries, for purposes of identifying possible additional full-scale test configurations

3.1.23
risk/benefit analysis
overall evaluation
objective calculation of the effects of a protective device, in comparison to a baseline MC in terms of the percentage of the population of impact configurations in which the device is beneficial versus the percentage in which it is harmful or in which it has no effect, for various injury indices

3.1.24
normal seating position
position in which an operator would generally ride on the specified MC

3.1.25
optional accessories
original equipment accessories as provided by the vehicle manufacturer

3.2 Definition of impact conditions in relation to accident data (see ISO 13232-2)

3.2.1
cell
region of five-dimensional space in which the dimensions are relative heading angle, OV impact speed, MC impact speed, OV contact point, and MC contact point (for accident analysis)

3.2.2
cell range
for each cell, the range of values for each of the five impact variables used to define the cell

3.2.3
nominal values
for each cell, the value of each of the five impact variables that represents that cell for the purpose of defining a unique impact condition for use in full-scale tests or computer simulations; typically, but not always, defined to be the centre of each cell

3.2.4
corner of the OV
point at which a vertical plane, set at 45° to the vertical longitudinal plane of the OV, contacts and is tangent to the surface of the bumper

3.2.5
centre line of the OV or MC
any line which is parallel to the ground and in the vertical plane which intersects the midpoints of the front wheel(s) and the rear wheel(s) of the OV or MC, at its test weight

3.2.6
overall length of the OV or MC
horizontal distance between the two vertical planes, each set at 90° to the plane of symmetry of the OV or MC, one contacting and tangent to the front extremity of the OV or MC, the other, to the rear extremity of the OV or MC, at its test weight

3.2.7
MC front unsprung assembly
that portion of the front fork assembly which is not supported by the suspension, including the forks, front wheel and axle, and possibly including other structural elements which are attached

3.3 Motorcyclist anthropometric impact dummy (see ISO 13232-3)

3.3.1
certification
compliance
achievement and documentation of a specified level of performance

3.3.2
frangible components
components of the anthropometric dummy which are intended to fail mechanically at prescribed force/deflection values in order to simulate human injury mechanisms and to record predicted injuries

3.3.3
knee compliance element
small, triangular, deformable plastic element which, when mounted in series with a brass shear pin, simulates the flexibility of knee ligaments, four of which are mounted in each injury indicating knee.

NOTE Two compiance elements simulate human knee flexibility for a standing dummy about the M_x axis, and two additional elements simulate human knee flexibility for a standing dummy about the M_z axis.

3.3.4
abdominal foam insert
dummy component fabricated from crushable foam which exhibits specified force/deflection properties and very limited spring back, which is installed in the test dummy abdomen, and used to measure the depth of abdominal penetrations to which the dummy is subjected during the course of the impact sequence

3.3.5
load cell simulator
non-instrumented structural replacement for a dummy-mounted load cell, having the same structural attachment configurations as a load cell, and used during tests in which a particular load cell and its associated data channels are not required

3.3.6
alternative products
products or devices which have the same critical characteristics as those specified, within a certain tolerance

NOTE Such critical characteristics may include: mass, dimensions, strength, dynamic response, accuracy, range, etc., depending on the nature of the device, and for wich depends on the nature of the product or device. As a guideline, it is suggested that the manufacturers' specification for the specified product be the basis for the equivalence, with the tolerance being 0,2 mm on critical dimensions, and otherwise within 2 % of the named manufacturer's specifications, unless otherwise specified in ISO 13232.

3.3.7
lot
number of components produced during a single run of a manufacturing process

