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Motorcycles — Measurement method for location of centre of gravity

Motocycles — Méthode de mesure de l'emplacement du centre de gravité

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 9130 was prepared by Technical Committee ISO/TC 22, *Road vehicles.*

Annex A forms an integral part of this International Standard.

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Introduction

The stability of a motorcycle is a very important element of its active safety. The motorcycle/rider combination and the environment in which this combination is used form a unique closed-loop system. However, the evaluation of the motorcycle/rider combination stability is extremely complex because of interaction of the intrinsic motorcycle stability, the influence of the position of the rider and his response to continuously changing conditions.

In the evaluation of motorcycle stability, the determination of the kinetic characteristics of the motorcycle/rider combination is to be considered an important part of the design parameters of the vehicle itself.

The test procedure described in this International Standard deals with one aspect of the kinetic characteristics: the determination of the centre of gravity of the motorcycle and of the motorcycle/rider combination.

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Motorcycles — Measurement method for location of centre of gravity

1 Scope

This International Standard specifies a measuring method for determining the location of the centre of gravity of the motorcycle and of the motorcycle/rider combination. It applies to two-wheeled motorcycles.

Other measuring methods can be used if it is demonstrated that the results are equivalent.

The measuring results obtained by the method given in this International Standard alone (see annex A) cannot be used for an evaluation of the vehicle stability because they deal with only one aspect of this very complex phenomenon.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3779 : 1983, *Road vehicles — Vehicle identification number (VIN) — Content and structure.*

49 CFR Part 572, subpart B [*Code of Federal Regulations*, issued by the National Highway Traffic Safety Administration (NHTSA)].

3 Equipment

3.1 The motorcycle shall be placed on a platform that is as light as possible, while being sufficiently rigid.

3.2 The motorcycle shall be fixed on the platform in such a way that the sprung mass keeps the position obtained under the condition quoted in item 1.11 in annex A, when the motorcycle or motorcycle/rider combination is tilted to the position shown in figure 3.

3.3 The rider shall be simulated by an anthropomorphic test dummy [1].

3.4 The dummy shall be fixed on the motorcycle by means of a rigid restraint jig.

3.5 The accuracy of the weighing and measuring devices for determining the dimensions shall be recorded.

4 Definition of axis systems

4.1 The motorcycle axis system (x, y, z) is a right-hand orthogonal axis system fixed in the motorcycle such that when the motorcycle is moving in a straight line on a level road, the x-axis is substantially horizontal, points forwards and is in the longitudinal plane of symmetry. The y-axis points to the rider's left side and the z-axis points upwards.

4.2 The earth-fixed axis system (X, Y, Z) is a right-hand orthogonal axis system fixed on the Earth. The X- and Y-axes are in a horizontal plane and the Z-axis points upwards.

5 Position of dummy

5.1 The hands of the dummy shall be on the steering handlebar grips and the feet shall be on the footrests in such a way that the front part of the heel touches the footrest and the foot is at 90° ± 5° to the lower leg.

In the case of a motorcycle with platform, the position of the feet shall be in accordance with the requirements of the manufacturer.

1) Test dummy as specified in 49 CFR Part 572, subpart B, or equivalent.

5.2 The projection of the position of the dummy on the x-z plane shall be defined by

— measuring the angle A between the x-axis and the line drawn from the knee pivot to the bottom of the heel;

— measuring the angle B between the x-axis and the line drawn from the shoulder pivot to the H-point.

6 Position of motorcycle

The roll angle of the motorcycle in relation to the platform shall be zero with a tolerance of ± 0,5°.

7 Measuring procedure

7.1 Abbreviations and symbols

The following abbreviations and symbols are used in 7.2, 7.3 and 7.4:

RMP: Rider/Motorcycle/Platform combination;

MP : Motorcycle/Platform combination;

P : Platform;

RM : Rider/Motorcycle combination;

M : Motorcycle;

m : Mass, in kilograms;

T : Period, in seconds;

i : RMP, MP, P, as appropriate;

j : RM, M, as appropriate;

NOTE — Further symbols are explained in the respective figures.

7.2 Location of centre of gravity along x-axis

The location of the centre of gravity along the x-axis may be determined from the following equations (see figure 1):

$$l_i = \frac{l_{iF}\,P_{iF} + l_{iR}\,P_{iR}}{P_{iF} + P_{iR}}$$

$$l_j = \frac{m_{jP}\,l_{jP} - m_P\,l_P}{m_j}$$

$$a_j = l_j - l_F$$

where

P_{iF} is the load indicated by the front weighing device of the i combination cited in 7.1;

P_{iR} is the load indicated by the rear weighing device of the i combination cited in 7.1.

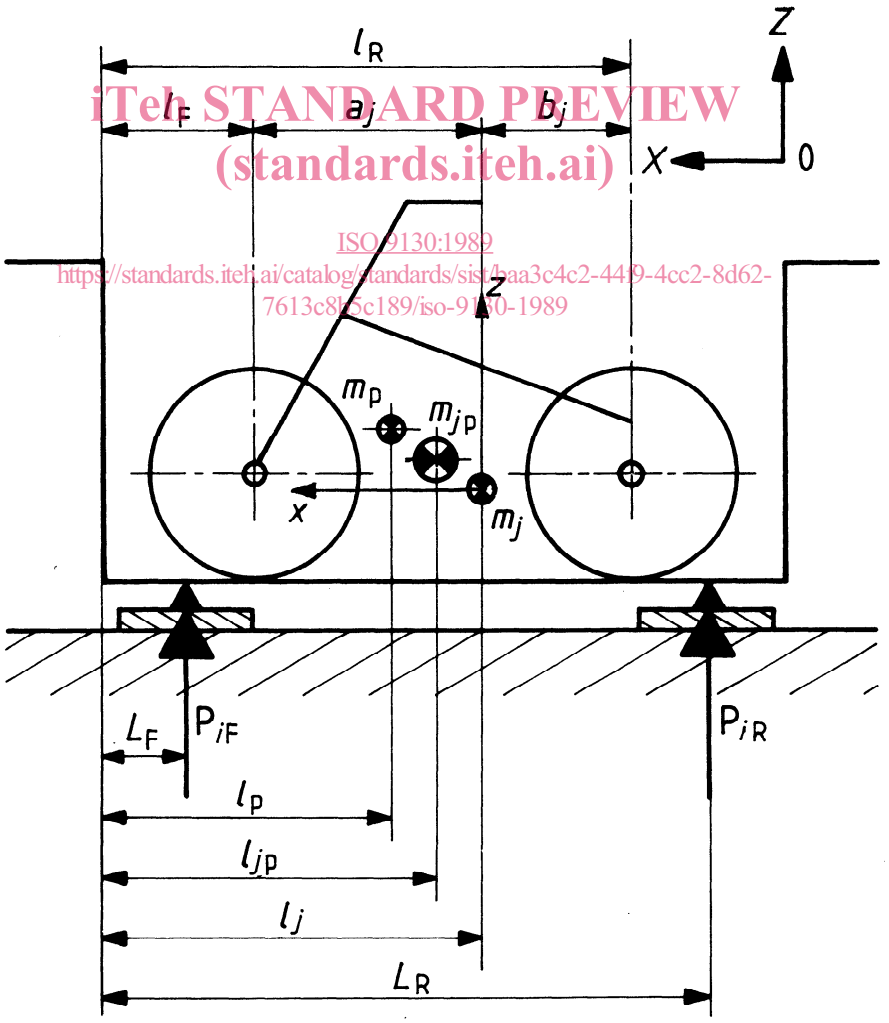

Figure 1 — Measurement procedure for location of centre of gravity along x-axis

7.3 Location of centre of gravity along y-axis

The location of the centre of gravity along the y-axis may be determined from the following equations (see figure 2):

$$l_i = \frac{l_L P_{iL} + l_R P_{iR}}{P_{iL} + P_{iR}}$$

$$l_j = \frac{m_{jP} l_{jP} - m_P l_P}{m_j}$$

$$D_j = l_j - l_o$$

where

P_{iL} is the load indicated by the left side weighing device of the i combination cited in 7.1;

P_{iR} is the load indicated by the right side weighing device of the i combination cited in 7.1.

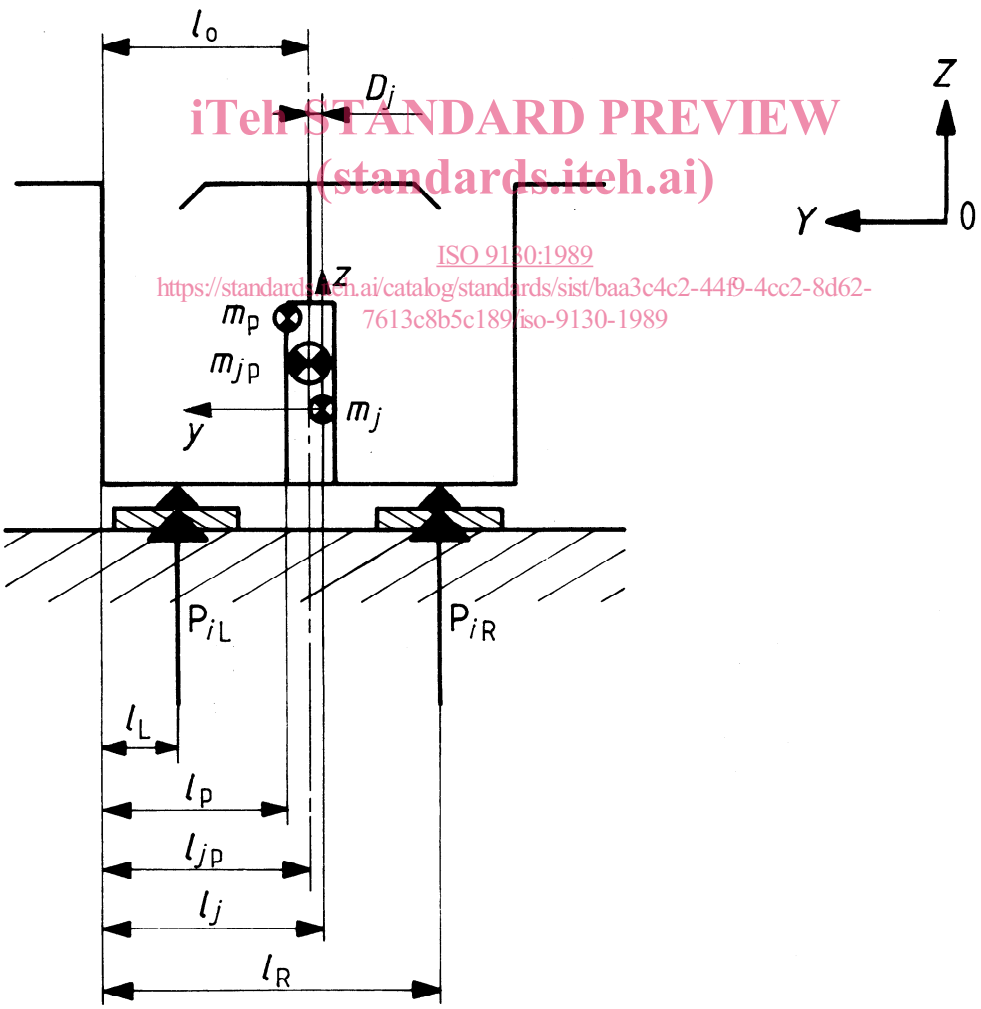

Figure 2 — Measurement procedure for location of centre of gravity along y-axis

7.4 Location of centre of gravity along z-axis

The location of the centre of gravity along the z-axis may be determined from the following equations (see figure 3):

$$d_i = c_i \tan \theta_o$$

$$c_i = \frac{m_k (a_o + b_o \tan \theta_k)}{m_i (\tan \theta_k - \tan \theta_o)}$$

$$c_j = \frac{m_{jP} c_{jP} - m_P c_P}{m_j}$$

$$h_{Gj} = h_o - c_j$$

where

m_i is the mass of RMP, MP or P;

m_k is the mass added to one side of the platform;

θ_o is the angle between the x-axis of RMP, MP or P and the horizontal plane under the condition m_i only;

θ_k is the angle between the x-axis of RMP, MP or P and the horizontal plane under the condition $m_i + m_k$.

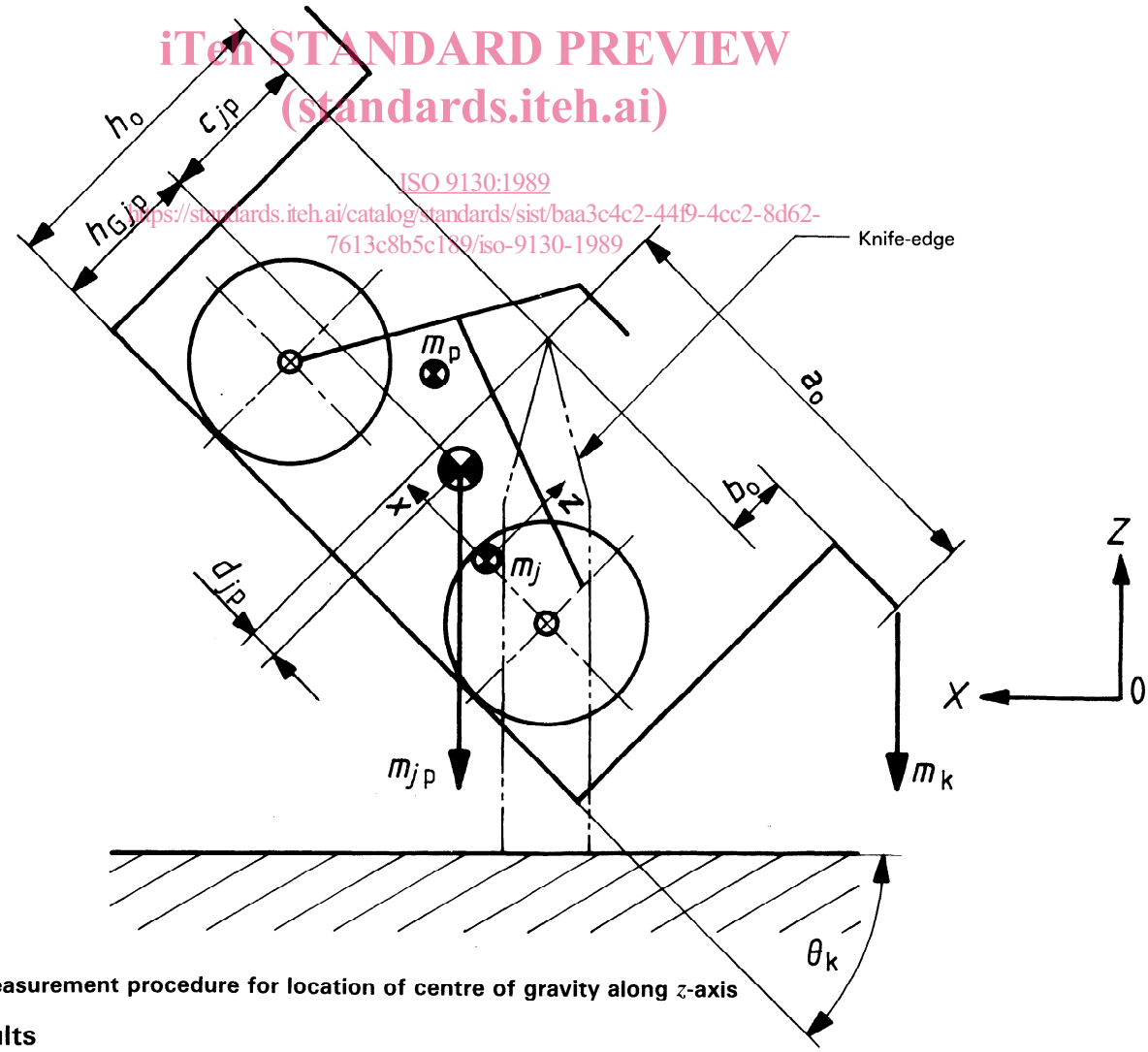

Figure 3 — Measurement procedure for location of centre of gravity along z-axis

8 Test results

Test results shall be presented as indicated in annex A.