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Motorcycle tyres — Method of measuring rolling resistance

*Pneumatiques pour motocycles — Méthode de mesure de la résistance au
roulement*

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ISO 13327:1998(E)**Foreword**

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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.

International Standard ISO 13327 was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*, Subcommittee SC 10, *Cycle, moped, motorcycle tyres and rims*.

Annex A forms an integral part of this International Standard. Annexes B and C are for information only.

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Motorcycle tyres — Method of measuring rolling resistance

1 Scope

This International Standard specifies methods for measuring rolling resistance, under controlled laboratory conditions, for new pneumatic tyres designed primarily for use on motorcycles. The relationship between values obtained and the fuel economy of the vehicle is undetermined, and such values are not intended to be used to indicate levels of performance or quality.

This International Standard is applicable to all motorcycle tyres.

It enables comparisons to be made between the rolling resistance of new tyres when they are free-rolling straight ahead, in a position perpendicular to the drum outer surface, and in steady-state conditions.

In measuring tyre rolling resistance, it is necessary to measure small forces in the presence of much larger forces. It is, therefore, essential that equipment and instrumentation of appropriate accuracy be used.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was 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 edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4223-1:1989, *Definitions of some terms used in the tyre industry — Part 1: Pneumatic tyres*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 4223-1 and the following definitions apply.

3.1

rolling resistance

F_r

loss of energy (or energy consumed) per unit of distance

NOTE — The SI unit conventionally used for the rolling resistance is the newton metre per metre (N·m/m).

This is equivalent to the drag force in newtons (N).

3.2

rolling resistance coefficient

C_r

ratio of the rolling resistance, in newtons, to the load on the tyre, in newtons

NOTE — This quantity is dimensionless.

3.3 capped inflation
process of inflating the tyre and allowing the inflation pressure to build up, as the tyre is warmed up while running

3.4 regulated inflation
process of inflating the tyre to the required pressure independent of its temperature, and maintaining this inflation pressure while the tyre runs under load

NOTE — This is most commonly done by using a regulated pressure source attached to the tyre through a rotating union.

3.5 parasitic loss
loss of energy (or energy consumed) per unit distance excluding tyre losses, and attributable to aerodynamic loss, bearing friction and other sources of systematic loss which may be inherent in the measurement

3.6 skim reading
type of parasitic loss measurement, in which the tyre is kept rolling, without slippage, while reducing the tyre load to a level at which energy loss within the tyre itself is virtually zero

3.7 machine reading
type of parasitic loss measurement, involving losses of the test machine, exclusive of losses in the rotating spindle which carries the tyre and rim

4 Test methods

The following alternative measurement methods are given in this International Standard:

- a) Force method: the reaction force at the tyre spindle.
- b) Torque method: the torque input to the test drum.
- c) Power method: the power input to the test drum.
- d) Deceleration method: the deceleration of the test drum and tyre assembly.

5 Test equipment

5.1 Drum specifications

5.1.1 Diameter

The test dynamometer shall have a cylindrical flywheel (drum) with a diameter of between 1,5 m and 3 m inclusive (reference drum diameter: 1,70 m). It should be noted that the results are different; see 9.3 for drum diameter correction for comparisons, if necessary.

5.1.2 Surface

The surface of the drum shall be smooth steel or textured and shall be kept clean (see clause A.6).

5.1.3 Width

The width of the drum test surface shall exceed the width of the test tyre tread.

5.2 Test rim

The tyre shall be mounted on a test rim, as specified in annex A.

5.3 Load, alignment, control and instrumentation accuracy

Measurement of these parameters shall be sufficiently accurate and precise to provide the required test data. The specific and respective values are shown in annex A.

5.4 Thermal environment

5.4.1 Reference conditions

The reference ambient temperature, as measured on the rotational axis of the tyre, 1 m away from the plane touching the nearest tyre sidewall, shall be 25 °C.

5.4.2 Alternative conditions

If the reference temperature cannot be obtained, the rolling resistance measurement shall be corrected to standard temperature conditions in accordance with 9.2.

5.4.3 Drum surface temperature

Care should be taken to ensure that the temperature of the test drum surface is approximately the same as the ambient temperature at the beginning of the test.

6 Test conditions

The test consists of a measurement of rolling resistance in which the tyre is inflated and the inflation pressure allowed to build up (i.e. "capped air").

6.1 Test speeds

The value shall be obtained at a drum velocity of

80 km/h for tyres marked with a speed symbol above "L";

50 km/h for tyres marked with a speed symbol "L" and below.

6.2 Test load

The standard test load shall be computed from

65 % of the maximum load capacity of the tyre for light and standard load versions;

80 % of the maximum load capacity of the tyre for reinforced version.

It shall be kept within the tolerance specified in annex A.

6.3 Test inflation pressure

The inflation pressure shall be

200 kPa for light and standard load versions;

250 kPa for reinforced version.

The inflation pressure shall be capped with the accuracy specified in A.4.1.

ISO 13327:1998(E)**6.4 Duration and velocity**

When the deceleration method is selected, the following requirements apply:

- a) for duration, Δt , the time increments shall not exceed 0,5 s;
- b) any variation of the test drum velocity shall not exceed 1 km/h.

7 Test procedure**7.1 General**

The choice of an individual method is left to the tester. For each method, the test measurements shall be converted to a rolling resistance force acting at the tyre/drum interface.

The test procedure steps described in 7.2 to 7.7 shall be followed in the sequence given.

7.2 Break-in

To ensure repeatability of measurements, an initial break-in and cooling period is required prior to the start of the test. Such a break-in should be carried out on a test drum of at least 1,5 m diameter for a period of at least 1 h, at a minimum velocity of 80 km/h, with the load and inflation pressure given in 6.2 and 6.3 respectively.

7.3 Thermal conditioning

Place the inflated tyre in the thermal environment of the test location for at least 3 h.

7.4 Pressure adjustment

After thermal conditioning, the inflation pressure shall be adjusted to the test pressure, and verified 10 min after the adjustment was made.

7.5 Warm-up

The tyre shall be run at constant test velocity until reaching a stabilised steady-state value of rolling resistance. A warm-up period of at least 30 min at the test speed is required.

7.6 Measurement and recording

The following shall be measured and recorded (see figure 1):

- a) test velocity, U_n ;
- b) load on the tyre normal to the drum surface, L_m ;
- c) test inflation pressure:
 - 1) initial, as defined in 7.4,
 - 2) final, for capped inflation;
- d) the driving torque on the drive shaft, T_t , the tyre spindle force, F_t , the input power, $V \times A$, or the deceleration of the test drum/tyre/wheel assembly, $\Delta\omega/\Delta t$, depending on the method;
- e) distance, r_L (see 8.2.1);