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Introduction

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For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

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- **Annotated drafts are not acceptable and will be rejected.**
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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 18511-2

Tyre abrasion rate measurement methods —

Part 2: Indoor test method by using an abrasion tester on external drum

ICS: 83.160.10

ISO/TC 31

Secretariat: **ANSI**

Voting begins on:
2024-03-08

Voting terminates on:
2024-05-31

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Foreword

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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).

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This document was prepared by Technical Committee ISO/TC 31, *Tyres, rims and valves*.

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Introduction

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Tyre abrasion rate measurement methods —

Part 2:

Indoor test method by using an abrasion tester on external drum

1 Scope

This document specifies the method for measuring tyre abrasion per distance travelled, under controlled laboratory conditions, for new pneumatic tyres designed primarily for use on passenger cars.

This document applies to all passenger car tyres with the following exclusions:

- Tyres not homologated for on road permanent usage (e.g. competition tyres);
- Free rolling tyres intended for trailers and caravan;
- Temporary tyres (marked “temporary” only);
- Tyres designed for competitions;
- Tyres fitted with additional devices to improve traction properties (e.g. studded tyres);
- Tyres designed only to be fitted to vehicles registered for the first time before 1 October 1990;
- Professional off-road tyres;
- Ice grip tyres.

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 3911, *Wheels and rims for pneumatic tyres — Vocabulary, designation and marking*

ISO 4000-1, *Passenger car tyres and rims (metric series) — Part 1: Tyres*

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

ISO 8855, *Road vehicles — Vehicle dynamics and road-holding ability — Vocabulary*

ISO 13473-1, *Characterization of pavement texture by use of surface profiles — Part 1: Determination of mean profile depth*

ISO 19447, *Passenger car tyres — Method for measuring ice grip performance — Loaded new tyres*

ASTM F3675, *Standard specification for 225/45R17 94V XL Radial Standard Reference Test Tyre*

ASTM F3676, *Standard specification for 225/45R17 94H XL Radial Standard Reference Test Tyre*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

Tyre abrasion

Tyre wear that is observed as the loss of tyre mass during usage

3.2

Mass loss

Amount of the mass lost due to tyre abrasion

Note 1 to entry: It is expressed in grams.

3.3

Abrasion rate

Mass loss per unit distance travelled normalized by tyre load

Note 1 to entry: It is expressed in mg/km/t.

3.4

Abrasion index

Index that is calculated as the abrasion rate of a candidate tyre compared to the abrasion rate of a reference tyre under the same test method and conditions specified in this document

3.5

Test tyre

Tyre that is used for an evaluation programme, either candidate tyres or reference tyres

3.6

Candidate tyre

T

Test tyre that is part of an evaluation programme and that is evaluated with the reference tyre using the same test method

3.7

Reference tyre

R

Special test tyre that is used as a benchmark in an evaluation programme

Note 1 to entry: The reference tyre (SRTT) is defined in

- (a) ASTM F3676 for the size 225/45R17 and referred to as "SRTT17S"
- (b) ASTM F3675 for the size 225/45R17 and referred to as "SRTT17W"

Note 2 to entry: Normal reference tyre (225/45R17 94V XL ASTM F3676) shall be used for testing candidate tyres not for severe snow condition, means normal, snow and special tyres not bearing M+S nor 3PMSF marks.

Note 3 to entry: Winter reference tyre (225/45R17 94H XL ASTM F3675) shall be used for testing candidate tyres for severe snow conditions (marked with 3PMSF symbol) and special use tyres bearing the marking M+S or 3PMSF.

3.8

Mean profile depth

MPD

General definition is described in ISO 13473-1 as informative reference, for characterization of surface roughness in macroscale.

3.9

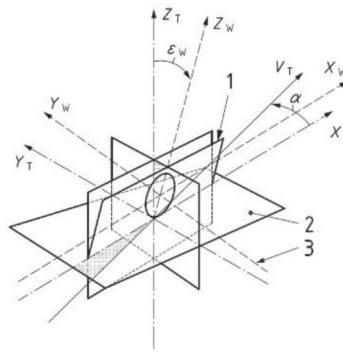
Micro-roughness

Surface roughness characterized in microscale, measured by altered filtering conditions from ISO 13473-1. Details are described in [4.2.3 b\)](#).

3.10

Tyre Coordination system

Tyre coordinate system specified in ISO 8855



Key

- 1 wheel plane
- 2 road plane
- 3 wheel-spin axis

Figure 1 — Tyre coordination system

3.11

Vertical load

F_z

Tyre normal force of a tyre exerted on the road resulting from the mass supported by the tyre, as the Tyre normal force specified in ISO 8855.

Note 1 to entry: It is expressed in Newtons.

3.12

Lateral force

F_y

Force of a tyre generated in lateral direction during cornering, as the Tyre lateral force specified in ISO 8855

Note 1 to entry: It is expressed in Newtons. Positive sign turning left. Negative sign turning right.

3.13

Longitudinal force

F_x

Force of a tyre generated in the longitudinal direction during acceleration or braking, as the Tyre longitudinal force specified in ISO 8855

Note 1 to entry: It is expressed in newtons.

Positive sign for speed increase.

Negative sign for speed decrease (e.g. braking).

3.14**Loaded radius** r_L

The distance from the tyre axis to the drum outer surface under steady-state conditions at 0 speed and 0 camber as well while the test load and inflation pressure is applied at room temperature and refer to the thermal conditioning of [section 6.2](#), in metre

Note 1 to entry: loaded radius of candidate tyre and reference tyre shall be measured in the same method.

3.15**Tyre torque** M_y

Moment on tyre rotation axle

3.16**Load index**

Numerical code associated with the maximum load a tyre can carry at the speed indicated by its speed symbol under the service conditions specified by the tyre manufacturer.

4 Test method**4.1 General**

This test method evaluates the mass loss of the candidate tyre relative to the reference tyre.

In measuring tyre tread wear per distance travelled, it is necessary to control normal load, lateral force and longitudinal force applied to a test tyre.

This test method uses a tread wear test equipment with a cylindrical flywheel (drum) with external surface of drum.

4.2 Drum specification**4.2.1 Tyre Wear Test Equipment**

Tread wear test equipment shall consist of a drum, a tyre carriage device, a loading device and adhesion prevention system. There can be one or two carriage devices.

4.2.2 Diameter

The test dynamometer shall have a cylindrical flywheel (drum) with a diameter of at least 1,7 m.

4.2.3 Surface

The test surface shall be applied to external surface of the cylindrical drum. The test surface of drum shall:

- a) have MPD measured at the start and end of the drum test not exceeding 2,0 mm, according to ISO 13473-1.
- b) have micro-roughness measured at the start and end of the drum test within the range from 0,07 mm to 0,4 mm. The measuring method of MPD described in ISO 13473-1 shall apply to the measurement of micro-roughness, except for sampling interval, resampling, high-pass and low-pass filtering, and segment length. The sampling interval shall not be more than 0,033 mm, and samples shall be taken at a fixed interval in the horizontal direction. Re-sample the signal to either 0,017 mm or 0,033 mm spacing; preferably 0,017 mm. For high-pass and low-pass filtering, the filters shall be of the Butterworth type, 2nd order, and have a cut-off at 3,0 mm and 0,1 mm texture wavelength, respectively. The segment length shall be 3,33 mm $\pm$ 0,33 mm.
- c) be textured with sands, stones or an alternative material, e.g., aluminium oxide resin.

- d) The drum surface shall be built with rigid and not deformable material.
- e) The test surface, including voids, shall be dry and clean for all measurements.
- f) The device for measurement of MPD must fulfil the specifications of ISO 13473-3 . The device for measurement of micro-roughness must fulfil the specifications of ISO 13473-3 except for horizontal resolution, which shall not be more than 0,033 mm.

The abrasion rate of the reference tyre for all surface shall be in the range

In case of SRTT17S, the range is 50 mg/km/t to 190 mg/km/t.

In case of SRTT17W, the range is 35 mg/km/t to 165 mg/km/t.

Abrasion Rate shall be calculated according to the method in [clause 8](#).

In case of sand paper used for surface it shall be replaced as specified in [Annex D](#).

When the drum surface no longer satisfies the conditions of the previous period, the surface should be replaced.

Total visible damage on the drum surface shall not be more than 0,1 % of the drum surface area.

Intermediate inspection of the abrasion rate for the reference tyre is recommended.

4.2.4 Width

The width of the test surface shall always exceed the width of the test tyre contact patch throughout entire test duration.

4.3 Tyre carriage and drive system

The tyre carriage and drive system shall be able to provide dynamic control of:

- a) tyre lateral force developed by the drag force produced by tyre slip angle during running.
- b) Longitudinal tyre force or torque developed by tractive force by the tyre during braking and accelerating.

Admitted deviation from the nominal value of load (F_z), lateral force (F_y), longitudinal force (F_x) and tyre torque (M_y) during the testing is:

F_z : ± 50 N or 1 % whichever is greater.

F_y : ± 100 N or 5 % whichever is greater, for the difference between input peaks and actually generated peaks.

F_x : ± 100 N or 5 % whichever is greater, for the difference between input peaks and actually generated peaks.

M_y : ± 40 Nm or 5 % whichever is greater, for the difference between input peaks and actually generated peaks.

4.4 Adhesion prevention system

4.4.1 Powder distribution

The treadwear test equipment shall have a powder distribution system to spray a controlled volume of talc or silica. Mixture of talc and silica is not allowed. The powder particle typical size can range from 0,1 μm to 100 μm .

The powder distribution system shall spray on the test surface near the test tyre contact patch so that abrasion fragments do not adhere to the tyre or test drum surface. The powder distribution system and materials shall be identical for the reference and candidate tyre during a test and remain constant during the

entire test. The powder delivery rate (measured by mass or volume) applied to the reference and candidate tyres shall be the same, with a maximum ± 10 % difference for each test.

4.4.2 Nozzle position

Nozzle position for powder distribution system shall be;

a) Blow-in type

In case of only one nozzle, centre of the nozzle should be positioned in symmetrical plane ($X = 0$). The distance from nozzles and centre of contact patch shall not exceed 35 cm from centre of contact patch.

In case of multiple nozzles, they shall be placed parallel to Y axis and symmetrically distributed respective to X axis. The distance from nozzles and centre of contact patch shall not exceed 35 cm.

Nozzles should be oriented towards contact patch entrance.

or

b) Dispersion type

The tester is covered with the enclosure coverings, powder should be evenly dispersed within the enclosure. The nozzle/nozzles should be placed parallel to Y axis and symmetrically distributed respective to X axis.

4.5 Load, alignment, control and instrumental accuracies

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 B](#).

4.6 Mass scale

Mass scale for test tyres shall have:

- a) mass capacity being able to weigh test tyre.
- b) The accuracy of the mass scale shall be within ± 2 g.

Mass scale shall be duly calibrated.

5 Test Conditions

5.1 General

The test consists of a measurement of tyre mass loss in which the tyre is inflated to the cold pressure as specified in [5.3](#) and the inflation pressure shall be allowed to build up (i.e. "capped inflation") and not be regulated by machine.

5.2 Test load

The standard test load F_z on the tyre to be measured shall be calculated from its LI load, corresponding to the maximum mass associated with the LI of the tyre.

The standard test load shall be computed from the values shown in [Table 1](#) and shall be kept within the tolerance specified in [Annex B](#).

5.3 Tyre inflation pressure

The inflation pressure shall be set in accordance with that shown in [Table 1](#) with the accuracy specified in [Annex B](#) and shall be capped.

Table 1 — Test loads and inflation pressures

Tyre type	Passenger car ^a	
	Standard load or light load	Reinforced or extra load
Load -% of maximum load capacity	80	80
Inflation pressure ^b (kPa)	210	250
^a For those passenger car tyres belonging to categories which are not shown in ISO 4000-1, Annex B, the inflation pressure shall be the inflation pressure recommended by the tyre manufacturer, corresponding to the maximum tyre load capacity, reduced by 30 kPa.		
^b The inflation pressure shall be capped with the accuracy specified in Annex B .		

5.4 Testing condition (Longitudinal force, lateral force, test speed, running distance)

Longitudinal force and lateral force shall be computed from the values shown in [Annex A](#). Test speed shall be in accordance with that shown in [Annex A](#).

Running distance shall be 5 000 km.

The total distance of an actual test shall not differ more than ± 5 % from the total input distance.

Reference tyre shall be mounted on a 7,5 Rim width code rim.

New candidate tyres shall be mounted on any rim requested and approved by the tyre manufacturer.

The rim width of candidate tyre shall be recorded. Tyres with special fitment requirements, such as asymmetric or directional design, shall also be mounted in accordance with these requirements: direction of rotation shall be respected.

The test shall be performed at null camber 0°.

6 Test procedure

6.1 General

The test procedure steps described below are to be followed in the sequence given.

Both reference and candidate tyres shall be new when starting the test.

Test tyres with specified direction of rotation shall be rolling in the forward direction.

Direction of rolling shall be kept in the same direction throughout the test.

Abrasion rate calculation uses actual test run distance.

6.2 Thermal conditioning

Place the inflated tyre in the thermal environment of the test location for a minimum of 3 h.

6.3 Pressure adjustment

After thermal conditioning, the inflation pressure shall be adjusted to the test pressure.

6.4 Thermal environment

During the test, the ambient temperature, at a distance of not less than 0,15 m and not more than 1 m from the tyre, shall be $25\text{ °C} \pm 5\text{ °C}$.

Average ambient temperature for reference and candidate tyre during test shall not differ by more than 2 degrees.

6.5 Mass measurement

The mass of tyre shall be measured before and after 5 000 km of run set out in [section 6.6](#) for both reference and candidate tyres.

6.6 Test cycle

6.6.1 Input condition

Both reference tyre and candidate tyre shall be tested according to input condition of [Annex A](#). The [Annex A](#) test condition of 250 km is defined as one test cycle, and the test cycle shall be repeated 20 times until 5 000 km is reached.

6.6.2 Basic test program (2 position drum)

Both reference tyre and candidate tyre shall be mounted different position of one drum. Testing of both reference tyre and candidate tyre shall be conducted at the same time.

Tyres mounted at the two positions shall be exchanged once after the completion of 2 500 km. Direction of rotation shall remain constant throughout the test.

A visual inspection of tyre is recommended after the completion of 2 500 km to ensure no tread chunking.

6.6.3 Alternative test program (1 position drum)

In case test of reference tyre and candidate tyre is not possible at the same time, the alternative test program is available. As Reference tyre (R) and Candidate tyre (T), test order is following:

R (1 000 km) – T (2 000 km) – R (2 000 km) – T (2 000 km) – R (2 000 km) – T (1 000 km)

Repeat a set of [Annex A](#) input conditions 4 times for 1 000 km and 8 times for 2 000 km.

A visual inspection of the test tyre is recommended following the same schedule as the tyre rotation to ensure no tread chunking is visible.

6.6.4 Test starting phase

Tyre should touch the drum with test speed equal to 0 km/h. Then the test load F_z should be applied at test speed equal to 0 km/h or at very low speed. After load application, test speed can be increased to the initial test value 60 km/h with a maximum longitudinal acceleration of 0,125 m/s² or maximum travelled distance of 35 km. During this starting phase should be free rolling conditions.

Distance run at starting phase shall not be counted.

6.7 Measurement and recording

The following shall be measured and recorded:

Item	Requirements
a) Test speed;	Sampling frequency ≥ 1 Hz
b) Tyre normal force to the drum surface;	Sampling frequency ≥ 1 Hz
c) Test inflation pressure: initial and end of the test, as defined in section 5.3 ;	Shall measure at the timings of: a) Before starting the test b) 3 or more hours after end of the test. Interim measurement during test is optional
d) Ambient temperature measured in degree °C;	Sampling frequency ≥ 1 Hz

Item	Requirements
e) Lateral force applied to the test tyre during the test.	Sampling frequency ≥ 10 Hz
f) Longitudinal force or torque applied to the test tyre during the test.	Sampling frequency ≥ 10 Hz
g) Mass of tyre;	Shall measure at the timings of: a) Before starting the test b) After end of the test. c) Tyre shall be cleaned to remove any dusts and dried.
h) MPD and micro-roughness of the test surface;	Shall measure at the timings of: a) Before starting the test b) After end of the test. Interim measurement during test is optional
i) Photograph of tyres after test program	Photographs of whole sector of tread after the test to record the surface as a proof of test completion in the right way and tyres are free from tread separation and detachment.

Note 1 to entry During the measurement of the force or torque applied to the test tyre, a moving average over one wheel revolution may be used to eliminate first and/or second harmonic of the tyre.

Note 2 to entry During the measurement of the force or torque applied to the test tyre, a low pass filter may be used to eliminate first and/or second harmonic of the tyre.

7 Validation

When a tyre has been subjected to the test method specified in [clause 4](#) using a test rim and a valve that undergo no permanent deformation and allow no loss of air, there shall be no visual evidence of tread, sidewall, ply, cord, inner liner, belt or bead separation, chunking, open splices, cracking, broken cords or rubber adhesion.

A visual inspection of reference tyres shall show no damage on reference tyres. If a reference tyre loses more than a total of 1 cm^2 of tread area (due to chunking or other mechanism), the tyre shall be considered as destroyed.

The following values measured from each parameter shall be with their tolerances as specified in [Table 2](#), otherwise the test results shall be rejected.

Table 2 — Validation of F_x , F_y , F_z

Parameter	Measurement	Corresponding input step No. in each cycle (see Table A.1)	Value to be verified	Tolerance
F_x	Maximum value in every test cycle (total 20 cycles)	No. 13	Maximum $F_x = F_z \times 0,325$	± 100 N or ± 5 %, whichever is greater
	Minimum value in every test cycle (total 20 cycles)	No. 770	Minimum $F_x = F_z \times (-0,245)$	± 100 N or ± 5 %, whichever is greater
	Response time of the first peak appearing in every test cycle (total 20 cycles)	No. 13	$t_{F_x, \text{Peak}} = 547,5$ s	± 5 s
	Response time of the last peak appearing in every test cycle (total 20 cycles)			
	RMS ^(a) of $G(x)$	-	$\text{RMS}_{G_x} = 0,059$	± 5 %
F_y	Maximum value in every test cycle (total 20 cycles)	No. 750 No. 762	Maximum $F_y = F_z \times 0,365$	± 100 N or ± 5 %, whichever is greater
	Minimum value in every test cycle (total 20 cycles)	No. 761	Minimum $F_y = F_z \times (-0,415)$	± 100 N or ± 5 %, whichever is greater
	Response time of the first peak appearing in every test cycle (total 20 cycles)	No. 3	$t_{F_y, \text{Peak}} = 388,4$ s	± 5 s
	Response time of the last peak appearing in every test cycle (total 20 cycles)			
	RMS ^(a) of $G(y)$	-	$\text{RMS}_{G_y} = 0,074$	± 5 %
F_x and F_y	RMS ^(a) of $G(x, y)$		$\text{RMS}_{G_{xy}} = 0,095$	± 5 %
F_z	RMS of F_z applied filter divided by F_z nominal	-	Average of F_z	± 50 N or ± 1 %, whichever is greater

Note 1 to entry:

(a) For the whole test of total 5 000 km, calculate the Root Mean Square (RMS) of $G(x)$ and $G(y)$ using the equations below:

$$\text{RMS}_{G_x} = \sqrt{\frac{1}{N} \times \sum_{i=1}^N \left(\frac{F_{x_i}}{F_{z_i}} \right)^2}$$

$$\text{RMS}_{G_y} = \sqrt{\frac{1}{N} \times \sum_{i=1}^N \left(\frac{F_{y_i}}{F_{z_i}} \right)^2}$$

$$\text{RMS}_{G_{xy}} = \sqrt{\frac{1}{N} \times \sum_{i=1}^N \frac{(F_{x_i})^2 + (F_{y_i})^2}{(\text{Average of } F_z)^2}}$$

Where;

i is the number of data acquired at a sampling frequency of 10 Hz.

N is the total number of data acquired.

F_x , F_y and M_y may be filtered by a low pass filter to remove noise of the output.

F_z shall be filtered as the moving average per one second.

8 Processing of measurement results

Calculation method for Abrasion Index and Abrasion rate are following:

$$M_{IT} = M_{Tb} - M_{Ta}$$

$$M_{IR} = M_{Rb} - M_{Ra}$$

M_{IT} is Mass loss of candidate tyre, in grams

M_{IR} is Mass loss of reference tyre, in grams

M_{Tb} is Mass of candidate tyre before test cycle, in grams

M_{Ta} is Mass of candidate tyre after test cycle, in grams

M_{Rb} is Mass of reference tyre before test cycle, in grams

M_{Ra} is Mass of reference tyre after test cycle, in grams

Abrasion Index; A_{ri} :

$$A_{ri} = A_{iT} \text{ (mg/km/t)} / A_{iR} \text{ (mg/km/t)}$$

Where,

A_{iT} Normalized abrasion rate (mg/km/t) of candidate tyre, $A_{iT} = M_{IT} \text{ (g)} / D_T \text{ (km)} / F_{zT} \text{ (t)} \times 1\,000 \text{ (mg/kg)}$

A_{iR} Normalized abrasion rate (mg/km/t) of reference tyre, $A_{iR} = M_{IR} \text{ (g)} / D_R \text{ (km)} / F_{zR} \text{ (t)} \times 1\,000 \text{ (mg/kg)}$

D_T is Testing mileage of candidate tyre (km)

D_R is Testing mileage of reference tyre (km)

F_{zT} is Test load (t) of candidate tyre

F_{zR} is Test load (t) of reference tyre

The reference tyre used to calculate the abrasion index shall be one of the tyres described in [section 3.7](#).

9 Measurement uncertainty

The measurement procedure described in [clause 6](#) is affected by several parameters (e.g., temperature variations, road and environmental conditions, measurement system uncertainty) that lead to variation in the resulting abrasion level observed for the same tyre. The source and nature of these perturbations are not completely known and sometimes affect the end result in a non-predictable way.

The uncertainties so determined are grouped as follows:

- variations expected on the same test drum with similar temperatures and road roughness (run-to-run);
- variations expected on the same test drum using different surface roughness, e.g., differences in the use history (month to month);
- variations between on different, apart from ambient conditions, equipment, staff, and road drum, surfaces conditions also are different (site-to-site).

Uncertainty data are given in [Table 3](#) for all tyre class of this document. The variability is given for a coverage probability of 95 %. The data express the variability of results for a certain tested tyre and do not cover product variation.

Until more specific knowledge is available, the data for site-to-site variability may be used in test reports to state the expanded measurement uncertainty for a coverage probability of 95 %.

Table 3 — Variability of measurement results for a coverage probability of 95 %

Tyre category	Run-to-run	Month to month	Site-to-site
C1 abrasion index	< 0,16	< 0,16	< 0,16

Values shown here are worst case estimation will be modified and based on additional data in the future.

Annex A (normative)

Input of test cycle

In order to calculate the input forces F_x and F_y , longitudinal and lateral acceleration indices, as $G(x)$ and $G(y)$ respectively, are introduced as below.

For torque control testing machine, tyre torque (M_y) is calculated with longitudinal force (F_x) and loaded radius (r_L).

$$F_x = F_z \times G(x) \text{ or } M_y = \text{Test load } (F_z) \times G(x) \times R_L$$

$$F_y = F_z \times G(y)$$

F_z is the test load defined in [3.10](#) and [5.2](#).

$G(x)$ and $G(y)$ represent the index compared to the standard acceleration due to gravity ($g = 9,806\,65 \text{ m/s}^2$).

[Table A.1](#) defines the time, $G(x)$, $G(y)$, and test speed of test cycle, where:

- 1) T represents the total test duration from the beginning of the test
- 2) At a point of test duration T , the values of $G(x)$ and $G(y)$ shall be equal to those listed in [Table A.1](#)
- 3) $G(x)$ and $G(y)$ shall change linearly between two adjacent points.

Therefore, the values of F_x and F_y will also change linearly from one point to another. The following graphs show samples of linear change for F_x or F_y with respect to T .

T means the driving time from starting test.

The value of $G(x)$ and $G(y)$ at driving time T is mentioned in [Table A.1](#).

$G(x)$ and $G(y)$ between each point changes linear through those two points.