BRITISH STANDARD

BS ISO 8710:2010

Motorcycles — Brakes and brake systems — Tests and measurement methods

ICS 43.140

National foreword

This British Standard is the UK implementation of ISO 8710:2010.

The UK participation in its preparation was entrusted to Technical Committee AUE/14, Motor cycles and mopeds.

A list of organizations represented on this committee can be obtained on request to its secretary.

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INTERNATIONAL STANDARD

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Motorcycles — Brakes and brake systems — Tests and measurement methods

Motocyles — Freins et systèmes de freinage — Méthodes d'essai et de mesure

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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 8710 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 22, *Motorcycles*.

This second edition cancels and replaces the first edition (ISO 8710:1995), which has been technically revised.

INTERNATIONAL STANDARD **ISO 8710:2010(E)**

Motorcycles — Brakes and brake systems — Tests and measurement methods

1 Scope

This International Standard specifies tests and measurement methods for service brake systems and, where applicable, associated parking brake systems of two-wheeled motorcycles (3-3), motorcycles with sidecar (3-4) and tricycles (3-5) which are intended for use on public roads, in order to establish uniform worldwide test procedures for braking systems.

This International Standard does not cover motorcycles which:

— have a maximum speed of less than 25 km/h;

— are equipped for disabled riders.

This International Standard sets out the following types of tests:

— dynamic tests:

  — dry stop test (single brake control actuated);

  — dry stop test (all service brake controls actuated);

  — high speed test;

  — wet brake test;

  — heat fade test;

— parking brake system test;

— failure tests:

  — partial failure test (for split service brake systems);

  — power-assisted brake system failure test.

NOTE The test methods (application, condition of the motorcycle, test procedure and parameters, measurement of performances) for all the tests defined in this International Standard are equivalent to the corresponding test methods prescribed by UNECE Global Technical Regulation No. 3.

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 3779, *Road vehicles — Vehicle identification number (VIN) — Content and structure*

ISO 7117, *Motorcycles — Measurement method for determining maximum speed*

3 Terms and definitions

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

3.1 Vehicle categories

NOTE Vehicle categories as defined in this clause correspond to those given in UNECE Special Resolution No. 1.

3.1.1
category 3 vehicle
power driven vehicle with 2 or 3 wheels designed and constructed for the carriage of persons, of goods, or of persons and goods

3.1.1.1
category 3-3 vehicle
two-wheeled motorcycle
two-wheeled vehicle with an engine cylinder capacity exceeding 50 cm^3 in the case of a thermic engine or a maximum design speed exceeding 50 km/h, whatever the means of propulsion

3.1.1.2
category 3-4 vehicle
motorcycle with sidecar
vehicle with three wheels asymmetrically arranged in relation to the longitudinal median plane with an engine cylinder capacity exceeding 50 cm^3 in the case of a thermic engine or a maximum design speed exceeding 50 km/h, whatever the means of propulsion

3.1.1.3
category 3-5 vehicle
tricycle
vehicle with three wheels symmetrically arranged in relation to the longitudinal median plane with an engine cylinder capacity exceeding 50 cm^3 in the case of a thermic engine or a maximum design speed exceeding 50 km/h, whatever the means of propulsion

3.2 Brake system and components

3.2.1
brake system
combination of parts (other than the engine), consisting of the control, the transmission(s) and the brake(s), the function of which is progressively to reduce the speed of a moving motorcycle, bring it to a halt and keep it stationary if it is already halted

3.2.2
control
part actuated directly by the rider to supply to the transmission or control the energy required for braking the motorcycle

3.2.3
transmission
combination of components which provide the functional link between the control and the brake

3.2.4
brake
parts of the brake system in which the forces opposing the movement of the motorcycle are developed

3.3 Types of brake systems

3.3.1
service brake system
brake system which is used for slowing the motorcycle when in motion

3.3.1.1
single brake system
service brake system which acts on only one axle

3.3.1.2
combined brake system
CBS
⟨two-wheeled motorcycles⟩ service brake system whereby at least two brakes on different wheels are actuated by the operation of a single control

3.3.1.3
combined brake system
CBS
⟨motorcycles with sidecar⟩ service brake system whereby the brakes on at least the front and the rear wheel are actuated by the operation of a single control

NOTE If the rear wheel and the sidecar wheel are braked by the same brake system, this is regarded as the rear brake.

3.3.1.4
combined brake system
CBS
⟨tricycles⟩ service brake system whereby the brakes on all the wheels are actuated by the operation of a single control

3.3.1.5
secondary brake system
second service brake system on a vehicle equipped with a combined brake system

3.3.1.6
split service brake system
SSBS
service brake system that operates the brakes on all wheels, consisting of two or more subsystems actuated by a single control designed so that a single failure in any subsystem does not impair the operation of any other subsystem

NOTE An example of a single failure in a subsystem is a leakage type failure of a hydraulic subsystem.

3.3.2
power-assisted brake system
brake system in which the energy necessary to produce the braking force is supplied by the physical effort of the rider assisted by one or more energy supplying devices

EXAMPLE Vacuum assisted (with vacuum booster).

3.4 Motorcycle loading

NOTE Vehicle masses as defined in this clause correspond to those given in UNECE Special Resolution No. 1.

3.4.1
laden motorcycle
motorcycle laden so as to reach its gross vehicle mass

3.4.2
lightly loaded motorcycle
motorcycle in the condition of mass in running order to which 15 kg are added, in order to account for the test equipment as described in 5.4

3.4.3
gross vehicle mass
maximum mass of the fully laden solo vehicle, based on its construction and design performances, as declared by the manufacturer

3.4.4
mass in running order
sum of unladen vehicle mass and 75 kg, in order to account for the driver's mass

3.4.5
unladen vehicle mass
mass of the vehicle with bodywork and all factory fitted equipment, electrical and auxiliary equipment for normal operation of vehicle, including liquids (fuel tank filled to at least 90 % of the rated capacity and the other liquid containing systems to 100 % of the capacity specified by the manufacturer), tools, fire extinguisher, standard spare parts, chocks and spare wheel, if fitted

3.5 Test parameters

3.5.1
test speed
V
motorcycle speed measured at the moment the rider begins to actuate the brake control(s)

NOTE For tests where simultaneous actuation of two controls is specified, the motorcycle speed is taken from the moment the first control is actuated.

3.5.2
mean fully developed deceleration
MFDD
d_{m}
average deceleration calculated from the moment the motorcycle reaches 80 % of the test speed until the moment the motorcycle reaches 10 % of the test speed

3.5.3
stopping distance
S
distance travelled by the motorcycle, measured from the moment the rider begins to actuate the braking system control until the moment the motorcycle comes to a stop

NOTE For tests where simultaneous actuation of two controls is specified, the distance travelled is taken from the moment the first control is actuated.

3.6
baseline test
stop or series of stops carried out in order to confirm the performance of the brake prior to subjecting it to a further test, such as the heating procedure or wet brake stop

3.7
engine disconnected
condition when the engine is no longer connected to the driving wheel(s)

3.8
initial brake temperature
temperature of the hottest brake before any brake application

3.9
maximum speed
V_{max}
speed which the motorcycle can attain when tested in accordance with ISO 7117

3.10
peak braking coefficient
PBC
measure of tyre to road surface friction based on the maximum deceleration of a rolling tyre

3.11
wheel lock
condition that occurs when there is a slip ratio of 1,00

4 Test site conditions

4.1 Test surface

The test surface for dynamic tests shall be clean, dry and substantially level (i.e. it shall not have a gradient in excess of 1 %). The surface shall afford good adhesion, i.e. it shall have a nominal peak braking coefficient (PBC) of 0,9, unless otherwise specified.

The parking brake system test is conducted on a specified gradient. The specified test slope shall have a clean and dry surface that does not deform under the weight of the motorcycle.

4.2 Wind speed

The average wind speed shall not exceed 5 m/s.

4.3 Ambient temperature

The ambient temperature shall be between 4 °C and 45 °C.

4.4 Test lane for dynamic tests

The test area immediately after the point at which the test is to commence shall be marked with a lane of sufficient length for the motorcycle to be brought to a stop.

In the case of two-wheeled motorcycles (3-3), this lane shall be 2,5 m wide. In the case of motorcycles with sidecar (3-4) and tricycles (3-5), this lane shall have a width of 2,5 m plus the motorcycle width.

5 Motorcycle preparation

5.1 Tyres

The tyres shall be inflated to the motorcycle manufacturer's recommended pressure levels as appropriate to the vehicle loading condition for the test.

5.2 Engine idle speed

The engine idle speed shall be set to the motorcycle manufacturer's specification.

5.3 Mass distribution

The mass distribution on the axles for laden motorcycle tests shall be in accordance with the motorcycle manufacturer's specifications and shall be noted in the test report.

5.4 Instrumentation

The motorcycle shall be prepared for the tests specified in Table 1 by the provision, the calibration, or the provision and calibration of existing instruments, as required.

Optional instruments may be added to provide data, but care shall be taken to ensure that no equipment significantly affects the brake system performance or the dynamic characteristics of the motorcycle.

Table 1 — Test sequence and related instrumentation

Test	Parameter (to measure/calculate)		Example of instrument
	Obligatory	**Optional**	
0. Burnishing procedure[a]	Speed		Calibrated speedometer, photoelectronic measuring systems
	Brake temperature		Rubbing thermocouple, embedded thermocouple
	Motorcycle mass		Load cells, weighbridge
	Deceleration		Motometer, third wheel, recording deceleration meter
1. Dry stop test (single brake control actuated)	Speed		Calibrated speedometer, photoelectronic measuring systems
	Brake temperature		Rubbing thermocouple, embedded thermocouple
	Control force		Force meter
	Stopping distance or MFDD (see 6.9.2)		Chalk-pellet gun, third wheel, ink jet marker Motometer, third wheel, recording deceleration meter
	Motorcycle mass		Load cells, weighbridge
		Force in transmission	Hydraulic pressure transducer, cable tension transducer
		Control travel	Linear potentiometer
2. Dry stop test (all service brake controls actuated)	Speed		Calibrated speedometer, photoelectronic measuring systems
	Brake temperature		Rubbing thermocouple, embedded thermocouple
	Control force		Force meter
	Stopping distance or MFDD (see 6.9.2)		Chalk-pellet gun, third wheel, ink jet marker Motometer, third wheel, recording deceleration meter
	Motorcycle mass		Load cells, weighbridge
		Force in transmission	Hydraulic pressure transducer, cable tension transducer
		Control travel	Linear potentiometer

Table 1 (*continued*)

Test	Parameter (to measure/calculate)		Example of instrument
	Obligatory	**Optional**	
3. High speed test	Speed		Calibrated speedometer, photoelectronic measuring systems
	Brake temperature		Rubbing thermocouple, embedded thermocouple
	Control force		Force meter
	Stopping distance or MFDD (see 6.9.2)		Chalk-pellet gun, third wheel, ink jet marker Motometer, third wheel, recording deceleration meter
	Motorcycle mass		Load cells, weighbridge
		Force in transmission	Hydraulic pressure transducer, cable tension transducer
		Control travel	Linear potentiometer
4. Wet brake test[a]	Speed		Calibrated speedometer, photoelectronic measuring systems
	Brake temperature		Rubbing thermocouple, embedded thermocouple
	Control force		Force meter
	Motorcycle mass		Load cells, weighbridge
	Deceleration throughout braking stop		Motometer, third wheel, recording deceleration meter
	Distance		Third wheel
		Force in transmission	Hydraulic pressure transducer, cable tension transducer
		Control travel	Linear potentiometer
5. Heat fade test[a]	Speed		Calibrated speedometer, photoelectronic measuring systems
	Brake temperature		Rubbing thermocouple, embedded thermocouple
	Control force		Force meter
	Stopping distance or MFDD (see 6.9.2)		Chalk-pellet gun, third wheel, ink jet marker Motometer, third wheel, recording deceleration meter
	Motorcycle mass		Load cells, weighbridge
	Time		Stopwatch
	Distance		Third wheel
	Deceleration throughout braking stop		Motometer, third wheel, recording deceleration meter
		Force in transmission	Hydraulic pressure transducer, cable tension transducer
		Control travel	Linear potentiometer
6. Parking brake system test	Time		Stopwatch
	Control force		Force meter
	Motorcycle mass		Load cells, weighbridge
	Brake temperature		Rubbing thermocouple, embedded thermocouple
		Control travel	Linear potentiometer

Table 1 (*continued*)

Test	Parameter (to measure/calculate)		Example of instrument
	Obligatory	**Optional**	
7. Partial failure test	Speed		Calibrated speedometer, photoelectronic measuring systems
	Brake temperature		Rubbing thermocouple, embedded thermocouple
	Control force		Force meter
	Stopping distance or MFDD (see 6.9.2)		Chalk-pellet gun, third wheel, ink jet marker Motometer, third wheel, recording deceleration meter
	Motorcycle mass		Load cells, weighbridge
		Force in transmission	Hydraulic pressure transducer, cable tension transducer
		Control travel	Linear potentiometer
8. Power-assisted brake system failure test	Speed		Calibrated speedometer, photoelectronic measuring systems
	Brake temperature		Rubbing thermocouple, embedded thermocouple
	Control force		Force meter
	Stopping distance or MFDD (see 6.9.2)		Chalk-pellet gun, third wheel, ink jet marker Motometer, third wheel, recording deceleration meter
	Motorcycle mass		Load cells, weighbridge
		Force in transmission	Hydraulic pressure transducer, cable tension transducer
		Control travel	Linear potentiometer

[a] Where this test result depends on the analysis of a deceleration trace provided by a recording system, the system shall have damping and frequency-response characteristics, such that the behaviour of the motorcycle under braking is faithfully reproduced.

5.5 Burnishing

5.5.1 General

Prior to submitting a motorcycle for tests, the motorcycle brakes shall be burnished. This procedure may be completed by the motorcycle's manufacturer.

5.5.2 Motorcycle condition

The motorcycle condition shall be as follows:

a) motorcycle lightly loaded;

b) engine disconnected.

NOTE If the mass of the lightly loaded motorcycle exceeds the mass of the laden motorcycle, the laden condition is used for the purposes of this subclause.

5.5.3 Procedure

The test procedure shall be as described below.

a) Test speed:

— initial speed: 50 km/h or 0,8 V_{max}, whichever is lower;

— final speed: 5 km/h to 10 km/h.

b) Brake application: each service brake system control actuated separately.

c) Motorcycle deceleration:

— single front brake system only: between 3,0 m/s^2 and 3,5 m/s^2;

— single rear brake system only: between 1,5 m/s^2 and 2,0 m/s^2;

— CBS or split service brake system: between 3,5 m/s^2 and 4,0 m/s^2.

d) Number of decelerations: 100 per brake system.

e) Initial brake temperature before each brake application: $\leqslant$ 100 °C.

f) For the first stop, accelerate the motorcycle to the initial speed and then actuate the brake control under the conditions specified until the final speed is reached. Then, reaccelerate to the initial speed and maintain that speed until the brake temperature falls to the specified initial value. When these conditions are met, reapply the brake as specified. Repeat this procedure for the number of specified decelerations. After burnishing, adjust the brakes in accordance with the motorcycle manufacturer's recommendations.

6 Test requirements

6.1 Brakes

Brakes and brake systems shall not be adjusted at any time during the dynamic tests.

After the tests, the components of the brake system shall be examined for signs of damage, permanent distortion, friction material detachment and brake fluid leakage.

6.2 Brake temperature measurement

The brake temperature shall be measured at approximately the centre of the braking path of the disc or drum using:

a) a rubbing thermocouple that is in contact with the surface of the disc or drum; or

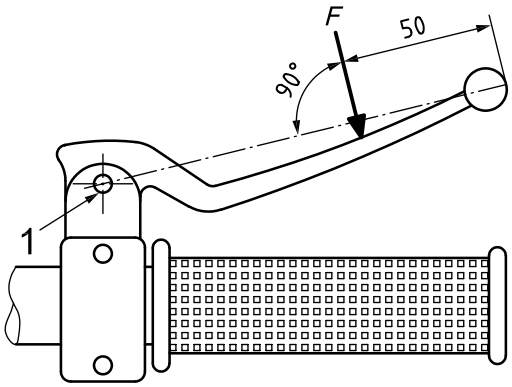
b) a thermocouple that is embedded in the friction material.

6.3 Application of control forces

The control forces shall be applied rapidly, up to the prescribed level, and then maintained constant during the stop.

For a hand control lever, the input force, F, is applied on the control lever's forward surface, perpendicular to the axis between the central axis of the lever fulcrum and its outermost point, on the plane along which the control lever rotates (see Figure 1).

Dimensions in millimetres



Key

1 lever fulcrum

F input force

Figure 1 — Force application for hand control levers

The input force is applied to a point located 50 mm from the outermost point of the control lever, measured along the axis between the central axis of the fulcrum of the lever and its outermost point.

For a foot control pedal, the input force is applied to the centre of the control pedal, at right angles.

6.4 Test sequence

The motorcycles may be subjected to either an individual test or a complete series of tests. When the complete series of tests is conducted, the test sequence given in Table 1 should be followed for subsequent tests in order to obtain repeatability. For the same reason and to minimize variations, it is recommended that the heat fade test be always the last test to be carried out.

6.5 Rider

During every dynamic test, the rider shall be seated on the saddle as for normal driving and shall maintain the same position throughout the test run.

6.6 Automatic transmission

Motorcycles with automatic transmission shall complete all tests, whether they are for “engine connected” or “engine disconnected”.

If an automatic transmission has a neutral position, the neutral position shall be selected for tests where “engine disconnected” is specified.

6.7 Motorcycle position and wheel lock

The motorcycle shall be positioned in the centre of the test lane for the beginning of each stop.

Stops shall be made without the motorcycle wheels passing outside the applicable test lane and without wheel lock.

6.8 Test speed tolerance

The speeds specified are subject to a tolerance of ± 5 km/h.

6.9 Measurement of dynamic performance

6.9.1 General

The method used to measure performance is as specified in the respective tests in Clause 7. The three different ways in which the service brake system performance may be measured are described in 6.9.2 to 6.9.4.

6.9.2 Mean fully developed deceleration (MFDD)

The mean fully developed deceleration (MFDD), d_m, expressed in m/s^2, shall be calculated using Equation (1):

$$d_m = \frac{v_b^2 - v_e^2}{25{,}92 \cdot (S_e - S_b)} \tag{1}$$

where

v_b is the motorcycle speed at 0,8 V, in km/h;

v_e is the motorcycle speed at 0,1 V, in km/h;

V is the motorcycle speed when the rider actuates the control, in km/h;

S_b is the distance travelled between V and v_b, in m;

S_e is the distance travelled between V and v_e, in m.

6.9.3 Stopping distance

The stopping distance, S, is expressed in metres.

To calculate the corrected stopping distance, S_s, expressed in metres, using the actual motorcycle speed, provided that the test speed tolerance (see 6.8) is not exceeded, Equation (2) shall be used.

$$S_s = 0{,}1 \cdot V_s + (S_a - 0{,}1 \cdot V_a) \cdot \frac{V_s^2}{V_a^2} \tag{2}$$

where

V_s is the specified motorcycle test speed, in km/h;

S_a is the actual stopping distance, in m;

V_a is the actual motorcycle test speed, in km/h.

6.9.4 Continuous deceleration recording

For the burnishing procedure and tests such as the wet brake test and the heating procedure in the heat fade test, there is a continuous recording of the vehicle instantaneous deceleration from the moment a force is applied to the brake control until the end of the stop.

6.10 Test report

The following information shall be recorded in the relevant test report(s) (see Annex A):

a) the test condition details (e.g. speeds, control forces, ambient conditions, vehicle identification, motorcycle loading conditions, relevant tyre information);

b) the results of each test (e.g. mean fully developed deceleration, stopping distance, residual performance);

c) the sequence in which the tests were performed, where applicable;

d) any deviation of the vehicle from its course, any abnormal vibration, noise, behaviour, etc.

7 Test procedures

7.1 Dry stop test (single brake control actuated)

7.1.1 General

The test is applicable to all motorcycle categories.

7.1.2 Motorcycle condition

The motorcycle condition shall be as follows:

a) motorcycle laden;

b) for motorcycles fitted with CBS and split service brake systems, the motorcycle is tested in the lightly loaded condition in addition to the laden condition;

c) engine disconnected.

NOTE No additional test is needed for motorcycles fitted with CBS and split service brake systems if the mass of the lightly loaded motorcycle exceeds the mass of the laden motorcycle.

7.1.3 Test conditions and procedure

The test conditions and procedure shall be as described below.

a) Initial brake temperature: $\geqslant$ 55 °C and $\leqslant$ 100 °C.

b) Test speed: 60 km/h or 0,9 V_{max}, whichever is lower.

c) Brake application: each service brake system control actuated separately.

d) Brake actuation force:

— hand control: $\leqslant$ 200 N;

— foot control:

i) $\leqslant$ 350 N for motorcycle categories 3-3 and 3-4;

ii) $\leqslant$ 500 N for motorcycle category 3-5.

e) Number of stops: a maximum of six stops for each control.

f) For each stop, accelerate the motorcycle to the test speed and then actuate the brake control under the conditions specified above.

7.1.4 Performance measurement

For each stop and each control (see 7.1.3) and for each motorcycle loading condition (see 7.1.2), the mean fully developed deceleration or stopping distance shall be measured and recorded.

7.2 Dry stop test (all service brake controls actuated)

7.2.1 General

The test is applicable to all motorcycle categories.

7.2.2 Motorcycle condition

The motorcycle condition shall be as follows:

a) motorcycle lightly loaded;

b) engine disconnected.

NOTE If the mass of the lightly loaded motorcycle exceeds the mass of the laden motorcycle, the laden condition is used for the purposes of this subclause.

7.2.3 Test conditions and procedure

The test conditions and procedure shall be as described below.

a) Initial brake temperature: $\geqslant$ 55 °C and $\leqslant$ 100 °C.

b) Test speed: 100 km/h or 0,9 V_{max}, whichever is lower.

c) Brake application: simultaneous actuation of both service brake system controls, if so equipped, or of the single service brake system control in the case of a service brake system that operates on all wheels.

d) Brake actuation force:

— hand control: $\leqslant$ 250 N;

— foot control:

i) $\leqslant$ 400 N for motorcycle categories 3-3 and 3-4;

ii) $\leqslant$ 500 N for motorcycle category 3-5.

e) Number of stops: a maximum of six stops.

f) For each stop, accelerate the motorcycle to the test speed and then actuate the brake control(s) under the conditions specified above.

7.2.4 Performance measurement

For each stop (see 7.2.3), the stopping distance shall be measured and recorded.

7.3 High speed test

7.3.1 General

The test is applicable to all motorcycle categories.

The test is not required for motorcycles with $V_{max} \leqslant 125$ km/h.

7.3.2 Motorcycle condition

The motorcycle condition shall be as follows:

a) motorcycle lightly loaded;

b) engine connected with the transmission in the highest gear.

NOTE If the mass of the lightly loaded motorcycle exceeds the mass of the laden motorcycle, the laden condition is used for the purposes of this subclause.

7.3.3 Test conditions and procedure

The test conditions and procedure shall be as described below.

a) Initial brake temperature: $\geqslant 55$ °C and $\leqslant 100$ °C.

b) Test speed:

— 0,8 V_{max} for vehicles with $V_{max} > 125$ km/h and < 200 km/h;

— 160 km/h for vehicles with $V_{max} \geqslant 200$ km/h.

c) Brake application: simultaneous actuation of both service brake system controls, if so equipped, or of the single service brake system control in the case of a service brake system that operates on all wheels.

d) Brake actuation force:

— hand control: $\leqslant 200$ N;

— foot control:

i) $\leqslant 350$ N for motorcycle categories 3-3 and 3-4;

ii) $\leqslant 500$ N for motorcycle category 3-5.

e) Number of stops: a maximum of six stops.

f) For each stop, accelerate the motorcycle to the test speed and then actuate the brake control(s) under the conditions specified above.

7.3.4 Performance measurement

For each stop (see 7.3.3), the mean fully developed deceleration or stopping distance shall be measured and recorded.

7.4 Wet brake test

7.4.1 General

The test is comprised of two parts that are carried out consecutively for each brake system:

— a baseline test based on the dry stop test with single brake control actuated (see 7.1);

— a single wet brake stop using the same test parameters as the baseline test, but with the brake(s) being continuously sprayed with water while the test is conducted, in order to measure the brakes' performance in wet conditions.

The test is applicable to all motorcycle categories.

The test is not applicable to the parking brake system unless this acts as the secondary brake system.

Drum brakes or fully enclosed disc brakes are exempt from this test unless ventilation or open inspection ports are present.

This test requires the motorcycle to be fitted with instrumentation that gives a continuous recording of brake control force and vehicle deceleration. The MFDD and the stopping distance measurements are not appropriate in this case.

7.4.2 Motorcycle condition

The motorcycle condition shall be as follows:

a) motorcycle laden;

b) for motorcycles fitted with CBS and split service brake systems, the motorcycle is tested in the lightly loaded condition in addition to the laden condition;

c) engine disconnected;

d) each brake is fitted with water spray equipment:

— for disc brakes, the water spray equipment is installed as follows (see Figure 2):

i) water is sprayed onto each brake with a flow rate of 15 l/h; the water is equally distributed on each side of the rotor;

ii) if the surface of the rotor has any shielding, the spray is applied 45 ° prior to the shield;

iii) if it is not possible to locate the spray in the position shown in Figure 2, or if the spray coincides with a brake ventilation hole or similar, the spray nozzle may be advanced by an additional 90 ° maximum from the edge of the pad, using the same radius;

— for drum brakes with ventilation and open inspection ports, the water spray equipment is installed as follows:

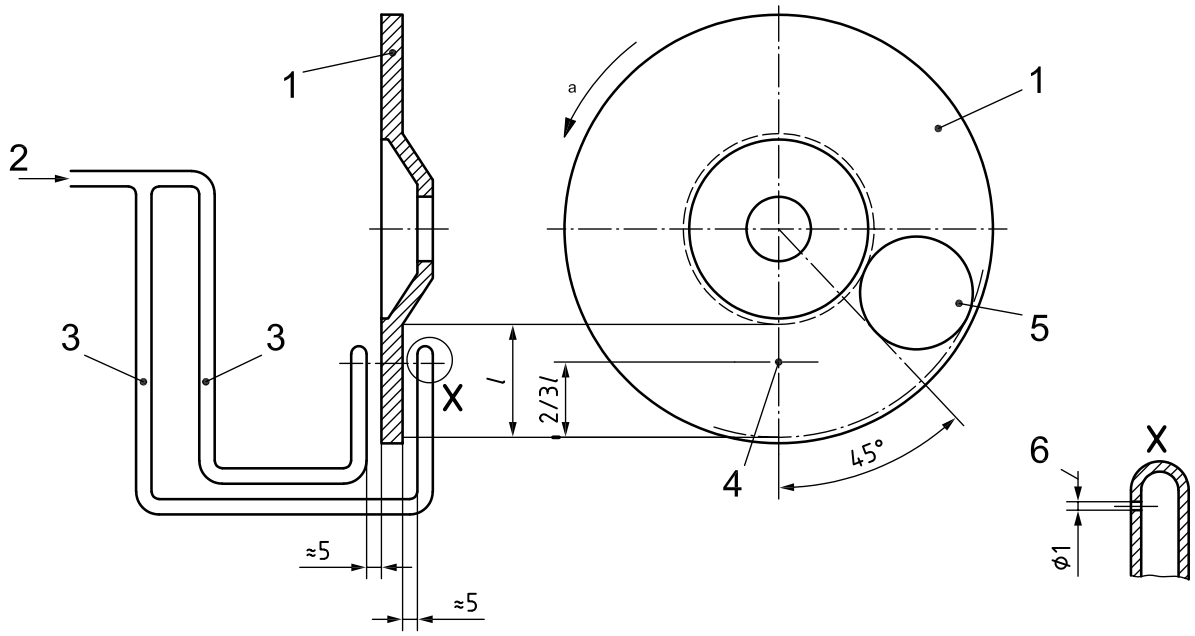
i) water is sprayed equally onto both sides of the drum brake assembly (on the stationary back plate and on the rotating drum) with a flow rate of 15 l/h;

ii) the spray nozzles are positioned two-thirds of the distance from the outer circumference of the rotating drum to the wheel hub centre;

iii) the nozzle position is > 15 ° from the edge of any opening in the drum back plate.

NOTE No additional test is needed for motorcycles fitted with CBS and split service brake systems if the mass of the lightly loaded motorcycle exceeds the mass of the laden motorcycle.

Dimensions in millimetres



Key

1 disc
2 from water tank
3 spray pipe
4 measurement at spray point (2/3 *l* from outer circumference)
5 pad
6 spray hole
l depth of the friction surface

a Direction of disc rotation.

Figure 2 — Water spray equipment for disc brakes

7.4.3 Test conditions and procedure

7.4.3.1 Baseline test

For the baseline test, the test conditions and procedure shall be as described below.

a) The test specified in 7.1 (dry stop test with single brake control actuated) is carried out for each brake system, but with the brake control force that results in a motorcycle deceleration of between 2,5 m/s^2 and 3,0 m/s^2, and the following is determined:

   — the average brake control force measured when the motorcycle is travelling between 80 % and 10 % of the specified test speed;

   — the average motorcycle deceleration in the period 0,5 s to 1,0 s after the moment of actuation of the brake control;

   — the maximum motorcycle deceleration during the complete stop but excluding the final 0,5 s.

b) Conduct three baseline stops and average the values obtained under bullet a) above.

7.4.3.2 Wet brake stop

For the wet brake stop, the test conditions and procedure shall be as described below.

a) The motorcycle is ridden at the test speed used in the baseline test set out in 7.4.3.1 with the water spray equipment operating on the brake(s) to be tested and with no application of the brake system.

b) After a distance of not less than 500 m, apply the average brake control force determined in the baseline test for the brake system being tested.

c) Measure the average motorcycle deceleration in the period 0,5 s to 1,0 s after the moment of actuation of the brake control.

d) Measure the maximum motorcycle deceleration during the complete stop, but excluding the final 0,5 s.

7.4.4 Performance measurement

The performance of the motorcycle shall be assessed in terms of deceleration achieved in the period of 0,5 s to 1,0 s after control application for both the baseline test and the wet brake stop, recording the average deceleration achieved for each stop and each control (see 7.4.3) and for each motorcycle loading condition (see 7.4.2). In addition, the maximum decelerations achieved during the complete stops, but excluding the final 0,5 s, shall be recorded for each stop and each control (see 7.4.3) and for each motorcycle loading condition (see 7.4.2).

The performance of a motorcycle with one or more wet brakes shall be expressed as a percentage of its performance with one or more dry brakes, using the average decelerations recorded above.

The maximum deceleration of a motorcycle with one or more wet brakes shall be expressed as a percentage of its maximum deceleration with one or more dry brakes, using the maximum decelerations recorded above.

7.5 Heat fade test

7.5.1 General

The test is comprised of three parts that are carried out consecutively for each brake system:

— a baseline test using the dry stop test with single brake control actuated (see 7.1);

— a heating procedure which consists of a series of repeated stops in order to heat the brake(s);

— a hot brake stop using the dry stop test with single brake control actuated (see 7.1), in order to measure the brakes' performance after the heating procedure.

The test is applicable to all motorcycle categories.

The test is not applicable to parking brake systems and secondary brake systems.

The heating procedure requires the motorcycle to be fitted with instrumentation that gives a continuous recording of brake control force and vehicle deceleration. The MFDD and the stopping distance measurements are not appropriate for the heating procedure. The baseline test and the hot brake stop require the measurement of either MFDD or the stopping distance.

7.5.2 Baseline test

7.5.2.1 Motorcycle condition

The motorcycle condition shall be as follows:

a) motorcycle laden;

b) engine disconnected.

7.5.2.2 Test conditions and procedure

The test conditions and procedure shall be as described below.

a) Initial brake temperature: $\geqslant$ 55 °C and $\leqslant$ 100 °C.

b) Test speed: 60 km/h or 0,9 V_{max}, whichever is lower.

c) Brake application: each service brake system control actuated separately.

d) Brake actuation force:

— hand control: $\leqslant$ 200 N;

— foot control:

i) $\leqslant$ 350 N for motorcycle categories 3-3 and 3-4;

ii) $\leqslant$ 500 N for motorcycle category 3-5.

e) Accelerate the motorcycle to the test speed, actuate the brake control under the conditions specified above and record the control force required to achieve the measured motorcycle braking performance.

7.5.3 Heating procedure

7.5.3.1 Motorcycle condition

The motorcycle condition shall be as follows:

a) motorcycle laden;

b) engine transmission:

— from the specified test speed to 50 % of the specified test speed: connected, with the highest appropriate gear selected, such that the engine speed remains above the manufacturer's specified idle speed;

— from 50 % of the specified test speed to standstill: disconnected.

7.5.3.2 Test conditions and procedure

The test conditions and procedure shall be as described below.

a) Initial brake temperature prior to first stop only: $\geqslant$ 55 °C and $\leqslant$ 100 °C.

b) Test speed:

— single brake system, front wheel braking only: 100 km/h or 0,7 V_{max}, whichever is lower;

— single brake system, rear wheel braking only: 80 km/h or 0,7 V_{max}, whichever is lower;

— CBS or split service brake system: 100 km/h or 0,7 V_{max}, whichever is lower.

c) Brake application: each service brake system control actuated separately.

d) Brake actuation force:

— for the first stop:

i) the constant control force that allows to achieve a deceleration rate of between 3,0 m/s^2 and 3,5 m/s^2 while the motorcycle is decelerating between 80 % and 10 % of the specified speed;

ii) determine this control force by performing three preliminary check stops at different values of control force using the specified motorcycle loading, test speed and engine transmission;

iii) then, use this to construct a graph of control force versus deceleration from which the appropriate force for between 3,0 m/s^2 and 3,5 m/s^2 may be determined by interpolation;

iv) if the motorcycle is unable to achieve the deceleration rate specified above, the constant control force to attain the maximum deceleration rate achievable with that brake shall be used;

— for the remaining stops: the same constant brake control force as used for the first stop.

e) Number of stops: 10.

f) Interval between stops: 1000 m.

g) Carry out a stop according to the conditions specified in this subclause and then immediately use maximum acceleration to reach the specified speed and maintain that speed until the next stop is made.

7.5.4 Hot brake stop test conditions and procedure

Perform a single stop under the conditions used in the baseline test (see 7.5.2) for the brake system that has been heated during the heating procedure (see 7.5.3). This stop is carried out within 1 min of the completion of the heating procedure with a brake control application force less than or equal to the force used during the baseline test.

7.5.5 Performance measurement

7.5.5.1 General

The performance of the motorcycle shall be assessed in terms of mean fully developed deceleration or stopping distance for both the baseline test and the hot brake stop, which shall be measured and recorded for each control (see 7.5.2).

To assess the effect of heat fade, the residual performance shall be determined. The residual performance is expressed as a ratio by comparing the braking performance recorded in the hot brake stop specified in 7.5.4 and the braking performance recorded in the baseline test specified in 7.5.2.

7.5.5.2 Residual performance (stopping distance)

In the case of the stopping distance, the motorcycle residual performance, P_r, shall be calculated using Equation (3):

$$P_r = \frac{S_{s2} + 0{,}067 \cdot V_s}{S_{s1}} \tag{3}$$

where

S_{s1} is the corrected stopping distance achieved in the baseline test, in m;

S_{s2} is the corrected stopping distance achieved in the hot brake stop, in m;

V_s is the specified test speed, in km/h.

7.5.5.3 Residual performance (MFDD)

In the case of the MFDD, the motorcycle residual performance, P_r, shall be calculated using Equation (4):

$$P_r = \frac{d_{m2}}{d_{m1}} \tag{4}$$

where

d_{m1} is the MFDD achieved in the baseline test;

d_{m2} is the MFDD achieved in the hot brake stop.

7.6 Parking brake system test

7.6.1 General

The test is applicable to motorcycle categories 3-4 and 3-5.

7.6.2 Motorcycle condition

The motorcycle condition shall be as follows:

a) motorcycle laden;

b) engine disconnected.

7.6.3 Test conditions and procedure

The test conditions and procedure shall be as described below.

a) Initial brake temperature: $\leqslant$ 100 °C.

b) Test surface gradient: 18 %.

c) Brake actuation force:

— hand control: $\leqslant$ 400 N;

— foot control: $\leqslant$ 500 N.

d) For the first part of the test, park the motorcycle on the test surface slope facing up the gradient by applying the parking brake system under the conditions specified above. If the motorcycle remains stationary, start the measurement of the test period.

e) On completion of the test with the motorcycle facing up the gradient, repeat the same test procedure with the motorcycle facing down the gradient.

7.6.4 Performance measurement

During the test, observe the behaviour of the motorcycle, both facing up and facing down the gradient (see 7.6.3), and record it in the test report.

The performance of the parking brake system shall be assessed in terms of its ability to hold the motorcycle stationary for 5 min when the motorcycle is both facing up and facing down the gradient.

7.7 Partial failure test (for split service brake systems)

7.7.1 General

The test is applicable to all motorcycle categories.

The test is only applicable to motorcycles which are equipped with split service brake systems.

The test is to confirm the performance of the remaining subsystem in the event of a hydraulic system leakage failure.

7.7.2 Motorcycle condition

The motorcycle condition shall be as follows:

a) motorcycle lightly loaded;

b) engine disconnected.

NOTE If the mass of the lightly loaded motorcycle exceeds the mass of the laden motorcycle, the laden condition is used for the purposes of this subclause.

7.7.3 Test conditions and procedure

The test conditions and procedure shall be as described below.

a) Initial brake temperature: $\geqslant$ 55 °C and $\leqslant$ 100 °C.

b) Test speeds:

— 50 km/h; and

— 100 km/h or 0,8 V_{max}, whichever is lower.

c) Brake actuation force:

— hand control: $\leqslant$ 250 N;

— foot control: $\leqslant$ 400 N.

d) Number of stops: a maximum of six stops for each test speed.

e) Alter the service brake system to induce a complete loss of braking in any one subsystem. Then, for each stop, accelerate the motorcycle to the test speed and actuate the brake control under the conditions specified above.

f) Repeat the test for each subsystem.

7.7.4 Performance measurement

For each stop, test speed and subsystem (see 7.7.3), the mean fully developed deceleration or stopping distance shall be measured and recorded.

7.8 Power-assisted brake system failure test

7.8.1 General

The test is applicable to all motorcycle categories.

The test is only applicable to motorcycles which are equipped with power-assisted brake systems.

The test is not conducted when the motorcycle is equipped with another separate service brake system.

The test is to confirm the performance of the service brake system in the event of failure of the power assistance.

7.8.2 Test conditions and procedure

Carry out the dry stop test with single brake control actuated, as specified in 7.1, for each service brake system, with the power assistance disabled.

7.8.3 Performance measurement

For each stop (see 7.1.3) and for each motorcycle loading condition (see 7.1.2), the mean fully developed deceleration or stopping distance shall be measured and recorded.

If the power assistance can be activated by more than one control, the above-mentioned performances shall be measured and recorded when each control is actuated separately.

Annex A
(normative)

Specimen format for test result sheet

Report No.: .....

A.1 Test motorcycle

Manufacturer: .....

Model: ..... Year: .....

Category (e.g. 3-3): ..... VIN (see ISO 3779): .....

Submitted by: .....

Engine type: ..... Capacity: ..... cm^3

Power rating: .....

No. of gears and selection means: .....

Maximum speed (ISO 7117): ..... km/h

A.2 Brake details

	Front	**Rear**
Brake type:	.....	.....
Transmission type:	.....	.....
Brake size:	.....	.....
Friction material (make and type):	.....	.....
Disc/drum material:	.....	.....
Disc/drum treatment (holes, slots, plating, etc.):	.....	.....

Brake system layout: .....

Special features: .....

A.3 Tyre details

	Front	**Rear**
Manufacturer:	.....	.....
Size:	.....	.....
Rating:	.....	.....
Type:	.....	.....
Pressure laden:	.....	.....
Pressure lightly loaded:	.....	.....

A.4 Test masses

Test rider: ..... kg

Equipment and instrumentation: ..... kg

Lightly loaded:	Total: ..... kg	Front: ..... kg	Rear: ..... kg
Laden:	Total: ..... kg	Front: ..... kg	Rear: ..... kg

A.5 Test equipment

Test equipment and instrumentation fitted: .....

Odometer reading, where fitted:

— start: .....

— finish: .....

— total: .....

A.6 Test conditions

Test date: .....

Rider's name (optional): .....

Observer's name (optional): .....

Test site: .....

Ambient temperature: ..... °C

Wind speed: ..... m/s

Other weather conditions: .....

Road surface and condition: .....

Name of test organization: .....

Date(s) of tests: .....

Date of report: .....

A.7 Dry stop test results (single brake control actuated)

Test No.: .....

Test date: .....

Odometer reading at start: .....

Motorcycle condition (delete whichever is not applicable)

Loading:	laden/lightly loaded
Control used:	hand/foot
Braked wheel(s):	front wheel(s)/rear wheel(s)/all

Gear selected: ..... (for automatic transmission)

Other conditions: .....

Stop No.	Test speed		Measured performance[a]			Control force	Remarks
	V_s km/h	V_a km/h	d_m m/s^2	S_a m	S_s m	N	

V_s is the specified test speed
V_a is the actual test speed
d_m is the mean fully developed deceleration
S_a is the actual stopping distance
S_s is the corrected stopping distance

[a] Performance is measured in terms of d_m or S_a, S_s.

A.8 Dry stop test results (all service brake controls actuated)

Test No.: .....

Test date: .....

Odometer reading at start: .....

Motorcycle condition (delete whichever is not applicable)

Loading: lightly loaded

Control used: hand/foot

Braked wheel(s): front wheel(s)/rear wheel(s)/all

Gear selected: ..... (for automatic transmission)

Other conditions: .....

Stop No.	Test speed		Measured performance		Control force	Remarks
	V_s km/h	V_a km/h	S_a m	S_s m	N	

V_s is the specified test speed
V_a is the actual test speed
S_a is the actual stopping distance
S_s is the corrected stopping distance

A.9 High speed test results

Test No.: .....

Test date: .....

Odometer reading at start: .....

Motorcycle condition (delete whichever is not applicable)

Loading: laden

Control used: hand/foot

Braked wheel(s): front wheel(s)/rear wheel(s) /all

Gear selected: ..... (for automatic transmission)

Other conditions: .....

Stop No.	Test speed		Measured performance[a]			Control force	Remarks
	V_s km/h	V_a km/h	d_m m/s^2	S_a m	S_s m	N	

V_s is the specified test speed

V_a is the actual test speed

d_m is the mean fully developed deceleration

S_a is the actual stopping distance

S_s is the corrected stopping distance

[a] Performance is measured in terms of d_m or S_a, S_s.

A.10 Wet brake test results

Test No.: .....

Test date: .....

Odometer reading at start: .....

Motorcycle condition (delete whichever is not applicable)

Loading: laden/lightly loaded

Control used: hand/foot

Braked wheel(s): front wheel(s)/rear wheel(s)/all

Gear selected: ..... (for automatic transmission)

Other conditions: .....

Condition	Stop No.	Test speed		Measured performance	Maximum deceleration	Average brake control force	Remarks
		V_s km/h	V_a km/h	a_m m/s^2	a_{max} m/s^2	N	
Dry brake							Test at between 2,5 m/s^2 and 3,0 m/s^2
Wet brake							Test at same control force as above

V_s is the specified test speed

V_a is the actual test speed

a_m is the average deceleration in the period 0,5 s to 1,0 s after control application

a_{max} is the maximum deceleration during the complete stop but excluding the final 0,5 s

Wet brake performance assessment:

$$\frac{a_m(\text{wet})}{a_m(\text{dry})}$$

and

$$\frac{a_{max}(\text{wet})}{a_{max}(\text{dry})}$$

A.11 Heat fade test results

Test No.: .....

Test date: .....

Odometer reading at start: .....

Motorcycle condition (delete whichever is not applicable)

Loading: laden

Control used: hand/foot

Braked wheel(s): front wheel(s)/rear wheel(s)/all

Gear selected: ..... (for automatic transmission)

Gear selected for the repeated stops: .....

Other conditions: .....

Condition	Stop No.	Test speed		Measured performance[a]			Control force	Remarks
		V_s km/h	V_a km/h	d_m m/s^2	S_a m	S_s m	N	
Baseline test								
Heating procedure (repeated braking every 1 000 m)								Laden test at between 3,0 m/s^2 and 3,5 m/s^2. Time to complete 10 brake stops = …
Hot brake stop								Within 1 min of the completion of the heating procedure

V_s is the specified test speed

V_a is the actual test speed

d_m is the mean fully developed deceleration

S_a is the actual stopping distance

S_s is the corrected stopping distance

[a] Performance is measured in terms of d_m or S_a, S_s.

Heat fade performance assessment (residual performance):

$$P_r = \frac{S_{s2} + 0{,}067 \cdot V_s}{S_{s1}}$$

or

$$P_r = \frac{d_{m2}}{d_{m1}}$$

A.12 Parking brake system test results

Test No.: .....

Test date: .....

Odometer reading at start: .....

Motorcycle condition (delete whichever is not applicable)

Loading: laden

Control used: hand/foot

Condition	Control force N	Observed motorcycle behaviour (e.g. elapsed time on the slope)
Motorcycle facing up gradient		
Motorcycle facing down gradient		

Other remarks: .....

.....

.....

A.13 Partial failure test results (for split service brake systems)

Test No.: .....

Test date: .....

Odometer reading at start: .....

Motorcycle condition (delete whichever is not applicable)

Loading: lightly loaded

Control used: hand/foot

Braked wheel(s): front wheel(s)/rear wheel(s)/all

Gear selected: ..... (for automatic transmission)

Other conditions: .....

Stop No.	Test speed		Measured performance[a]			Control force	Remarks
	V_s km/h	V_a km/h	d_m m/s^2	S_a m	S_s m	N	

V_s is the specified test speed

V_a is the actual test speed

d_m is the mean fully developed deceleration

S_a is the actual stopping distance

S_s is the corrected stopping distance

[a] Performance is measured in terms of d_m or S_a, S_s.

A.14 Power-assisted braking system failure test results

Test No.: .....

Test date: .....

Odometer reading at start: .....

Motorcycle condition (delete whichever is not applicable)

Loading: laden/lightly loaded

Control used: hand/foot

Braked wheel(s): front wheel(s)/rear wheel(s)/all

Gear selected: ..... (for automatic transmission)

Other conditions: .....

Stop No.	Test speed		Measured performance[a]			Control force	Remarks
	V_s km/h	V_a km/h	d_m m/s^2	S_a m	S_s m	N	

V_s is the specified test speed

V_a is the actual test speed

d_m is the mean fully developed deceleration

S_a is the actual stopping distance

S_s is the corrected stopping distance

[a] Performance is measured in terms of d_m or S_a, S_s.

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