



## INDUSTRY STANDARD

# Construction and safety requirements for off-road motorcycles

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## 0. Introduction

ACEM – the motorcycling industry in Europe has established this standard in the absence of a European harmonised standard and in preparation of the work of a future CEN standard.

In the context of this standard, the term “off-road motorcycle” refers to single track, two-wheeled, ride-on vehicles that are not intended to travel on the public road.

This standard represents the state-of-the-art of off-road motorcycles. However it cannot not give presumption of conformity with the essential health and safety requirements of the Machinery Directive as only a harmonised standard can do that. A harmonised standard is currently under preparation by CEN TC354 WG1. Users of this standard are advised to closely follow the work by CEN.

## 1. General

This Industry Standard specifies safety requirements and their verification for the design and construction of off-road motorcycles.

In the case that particularities of the vehicle require alternative levels of safety, other provisions, tailored to the specific vehicle design, can be applied as well.

In addition, the machine shall be designed according to the principles of EN ISO 12100 for relevant but not significant hazards, which are not dealt with by this standard.

## 2. Braking

### 2.1. General

Both wheels shall be braked. The brakes shall be capable either of being operated independently, or combined.

The brakes shall be tested in accordance with the conditions and procedures as described in Annex 1 to this standard.

When the brakes are tested, the stopping distance or the MFDD shall be as specified in the following tables:

Calculation of MFDD:

$$d_m = \frac{V_b^2 - V_e^2}{25.92 \cdot (S_e - S_b)} \quad \text{in m/s}^2$$

where:

$d_m$  = mean fully developed deceleration

$V_1$  = vehicle speed when rider actuates the control

$V_b$  = vehicle speed at 0.8  $V_1$  in km/h

$V_e$  = vehicle speed at 0.1  $V_1$  in km/h

$S_b$  = distance travelled between  $V_1$  and  $V_b$  in metres

$S_e$  = distance travelled between  $V_1$  and  $V_e$  in metres

**2.2. Performance of braking system**

**2.2.1. Independent brake system**

Single brake control actuated:

	STOPPING DISTANCE (S) (Where V is the specified test speed in km/h and S is the required stopping distance in m)	MFDD (Corresponding mean fully developed deceleration (m/s <sup>2</sup> ))
Front wheel braking only	$S \leq 0.1 V + 0.0087 V^2$	$\geq 4.4 \text{ m/s}^2$
Rear wheel braking only	$S \leq 0.1 V + 0.0133 V^2$	$\geq 2.9 \text{ m/s}^2$

All brake controls actuated:

	STOPPING DISTANCE (S) (Where V is the specified test speed in km/h and S is the required stopping distance in m)
Both wheels braking	$S \leq 0.0060 V^2$

**2.2.2. Combined brake system**

Single brake control actuated:

	STOPPING DISTANCE (S) (Where V is the specified test speed in km/h and S is the required stopping distance in m)	MFDD (Corresponding mean fully developed deceleration (m/s <sup>2</sup> ))
	$S \leq 0.1 V + 0.0076 V^2$	$\geq 5.1 \text{ m/s}^2$

All brake controls actuated:

	STOPPING DISTANCE (S) (Where V is the specified test speed in km/h and S is the required stopping distance in m)
Both wheels braking	$S \leq 0.0060 V^2$

**3. Controls**

The following controls shall be present unless otherwise stated.

**3.1. Engine ignition switch (optional)**

In the case of a rotary switch, the direction of motion shall be clockwise from the ignition "off" position to the ignition "on" position.

**3.2. Engine starter switch (optional)**

No specific requirements

**3.3. Speed control**

All motorcycles shall be equipped with a means of controlling speed through a throttle control. The throttle control shall be located on the right side of the handlebar and shall be operable without removing the hand from the handlebar. The throttle control shall be self-closing to an idle position upon release of the operator's hand or thumb from the control.

### **3.4. Engine cut-out**

Each motorcycle shall be equipped with an ignition or engine cut-out switch, easy to operate when the rider is in the normal operating position.

The wiring to the engine cut-out switch shall be well protected and routed to avoid snagging on external obstacles.

### **3.5. Brake control**

2 brake controls shall be installed.

These controls shall be levers either operated by hand on the handlebar or operated by the right foot.

### **3.6. Clutch control (optional)**

If present, the clutch control shall be a hand-lever and positioned on the left side of the handle bars.

### **3.7. Gear selector for motorcycles with manually operated gearboxes**

The gear selector shall be operated by a foot lever positioned on the left side of the motorcycle or alternatively, a selector switch on the handlebar. A detent position shall be provided for neutral.

### **3.8. Audible warning device (optional)**

The control for this device (if present) shall be operated by a push button located at the left side of the handle bar.

### **3.9. Lighting and light-signalling controls (optional)**

#### **3.9.1. Light control switch**

In the case of a rotary switch, operation of the switch in a clockwise direction shall engage, progressively, the motorcycle's position lights and then the motorcycle's main lights. This shall not prevent the inclusion of additional switch positions provided that they are clearly indicated. If present, the light control switch may be combined with the ignition switch if so desired.

#### **3.9.2. Main beam / dipped beam switch**

The control for this device (if present) shall be located so that it can be operated without the rider lifting his hand from the hand grips.

#### **3.9.3. Headlight flasher control**

The control for this device (if present) shall be adjacent to the main beam / dipped switch or shall be an additional function of the latter.

### **3.9.4. Direction indicator control**

The control for this device (if present) shall be located on the handlebars. The control shall be so designed that, when viewed from the rider's seat operation of the left hand portion, or movement to the left, of the control actuates the left side indicators and vice-versa for the right side indicators. The control shall be clearly marked in such a manner as to indicate the side of the motorcycle on which the control actuates the indicators.

### **3.10. Cold starting device control (optional)**

If present, the control for this device shall be so placed as to be reasonably and conveniently accessible to the rider.

### **3.11. Fuel shut-off control (for carburettor-type engines only)**

Motorcycles having a natural gravity fuel supply system to the carburettor must be fitted with a fuel shut-off system located underneath the tank (not at the carburettor intake).

### **3.12. Speed limiter (optional)**

A speed-limiting device is an incremental device that, when preset at its minimum, prevents speeds above 20 km/h.

If present, the device shall require the use of a tool for adjustment, and such adjustment shall not be possible by the rider when moving. The device shall be resistant to shock and vibration.

## **4. Risk of loss of stability**

### **4.1. Dynamic stability**

To avoid any excessive movement of the motorcycle when steering, there must be stops to prevent over steering.

The size of the tyres fitted shall be stated in the owner's manual and shall be suitable for the operating conditions of the motorcycle as intended and foreseen by the manufacturer.

The maximum load rating (as specified by the tyre manufacturer) of every tyre with which the motorcycle is fitted shall be at least equal to the maximum permissible axle mass as declared by the manufacturer.

The prop stand in retracted position shall under no circumstances touch the ground when turning.

### **4.2. Static stability**

In accordance with the test conditions and procedures set out in Annex 2 to this standard,

4.2.1. Prop stands (if present) must:

- 4.2.1.1. be designed and constructed in such a way that they do not close automatically if the angle of lean is altered unexpectedly (for example, if the motorcycle is pushed lightly by a third party);
- 4.2.1.2. be able to support the motorcycle in such a way as to provide its lateral stability whether the motorcycle is on a horizontal supporting surface or on a slope in order to prevent its leaning further too easily (and in so doing does not rotate about the point of support provided by the prop stand) or is moved too easily into a vertical position and beyond (and in so doing does not swing over to the side opposite the prop stand);
- 4.2.1.3. be able to support the motorcycle in such a way as to maintain stability when the motorcycle is parked on a slope.

4.2.2. Centre stands (if present) must be able to support the motorcycle with either one or both wheels in contact with the supporting surface or without any of the wheels being in contact with that surface in such a way as to confer stability on that motorcycle:

- 4.2.2.1. on a horizontal supporting surface;
- 4.2.2.2. in a leaning position;
- 4.2.2.3. on a slope.

## 5. Risk of burning to hot surfaces

### 5.1. Parts that are in constant contact with the rider

The surface temperature of parts that are in constant contact with the rider, when in normal riding position, should not be more than 48°C

### 5.2. Parts that are likely to be contacted momentarily by the rider

The surface temperature of parts that are likely to be contacted momentarily by the rider, when in normal riding position, should not be more than 70°C

## 6. Risks due to sharp edges

### 6.1. Handlebars and handlebar levers

#### 6.1.1. Handlebars

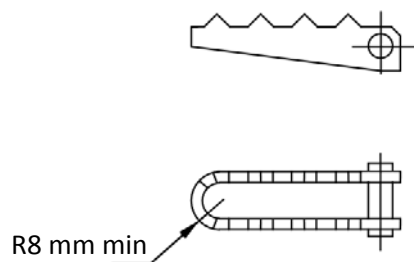
The ends of handlebars shall be rounded or covered with soft rubber or plastic having a hardness of less than 60 Shore A. The ends of handlebars shall not be open-ended tubes.

#### 6.1.2. Handlebar levers

The end of the handlebar levers (clutch and brake) shall have a radius of curvature of at least 3 mm.

### 6.2. Footrests

Footrests may be of a folding type but in this case must be fitted with a device which automatically returns them to the normal position and they must be rounded with a spherical radius of not less than 8 mm (see drawing). If the latter is not present, an integral protection is to be provided at the end of the footrest which must have at least 8 mm radius.



### 6.3. Other items

Radiator covers (shields) must be made of flexible materials only.

Large plastic parts shall be flexible and unbreakable at normal operating temperatures.

All other parts that are likely to be contacted by the rider during riding shall have no sharp edges.

## 7. Risk related to moving parts

### 7.1. Chain and belt drive

Any points where the drive chain or belt enters a sprocket shall be guarded to prevent accidental ingress of body parts. Additional guarding shall be fitted if riding control requires body parts to be in close proximity to the transmission.

## 8. Footrests

Footrests shall have an anti-slip surface.

## 9. Fuel system

### 9.1. Fuel tank

Liquid fuel shall be contained in a tank either of metal, or alternatively plastics having a minimum wall thickness of 1,5 mm.

Fuel tanks must be made with materials the thermal, mechanical and chemical behaviour of which continue to be appropriate under their intended conditions of use.

A fuel tap shall be used if gravity feed is used. The filler neck shall be at least 25 mm in diameter and it shall allow sight of the fuel level to avoid overfilling.

### 9.2. Fuel lines

To prevent excessive flow from the fuel tank, the fuel feed system shall have a fuel flow limitation device (e.g. a float valve installed in the carburettor).

## 10. Batteries (optional)

If present, batteries shall be retained and, if necessary, shielded to prevent leakage or short circuit.

## 11. Automatic transmission (optional)

For motorcycles with an electric starter, a device shall be fitted to prevent the motorcycle from running away when started with too much throttle applied.

## 12. Lighting and light-signalling (optional)

If lighting and light-signalling devices are not present, the owners' manual shall contain adequate warning to avoid operation in low visibility conditions (e.g. at night)

If present, lighting devices shall meet the following requirements:

### 12.1. Main beam / dipped beam

Installation: UN ECE Regulation 53. Performance: UN ECE Regulation 112 or 113.

Or:

SAE Recommended Practice SAE J1623.

Or:

JIS 5500

### 12.2. Rear light (Tail light)

No requirements

### 12.3. Stop light

No requirements

### 12.4. Direction indicators

Installation: UN ECE Regulation 53. Performance: UN ECE Regulation 50.

## 13. Audible Warning device (optional)

The audible warning device (if present) shall meet the requirements of ISO 6969:2004 or UN ECE Regulation 28.

## 14. Risks relating to fire

### 14.1. Fuel hoses

The fuel hoses must be firmly fastened by bridles and should not be in close proximity of the engine or the exhaust pipe.

The fuel hoses must be made with materials the thermal, mechanical and chemical behaviour of which continue to be appropriate under their intended conditions of use.

### 14.2. Fuel leakage

Fuel tanks must be made in such a way as to withstand corrosion. They must pass the leak-tightness tests carried out at a pressure that is twice the relative service pressure and, in any case, is at least equal to an absolute pressure of 130 kPa. Any excess pressure or any pressure exceeding the service pressure must be automatically released by appropriate devices (orifices, safety valves, etc.).

In normal operating position (i.e. upright), the fuel must be unable to flow from the filler cap or any devices fitted in order to release excess pressure.

Fuel leakage (e.g. via devices to release excess pressure in case of fall down) should not run close to the engine, exhaust, electrical equipment or the rider's clothing.

### 15. Risks relating to inadequacy of mechanical strength

The design, construction and mounting of the motorcycle and its components must be such that it displays reasonable and adequate mechanical strength of parts with due regard to the normal conditions of use, and in particular regardless of any vibrations to which it may be subjected.

### 16. Risks relating to throwing objects

To limit the risk of throwing objects, the motorcycle shall be equipped with front and rear mudguards. Mudguards must be made of flexible materials only (i.e. plastic).

The mudguards must project laterally beyond the tyre on each side. The front mudguard must cover the circumference of the wheel at an angle sufficient enough to protect the rider from mud.

### 17. Risks relating to electromagnetic disturbance

All motorcycles must be designed and constructed in such a way that, under normal conditions of use, they meet the requirements describes in 5.2, 5.3 and 5.4 of Directive 97/24/EC Chapter 8<sup>1</sup>.

### 18. Instructions for purchasers and riders

Each motorcycle shall be accompanied by:

#### 18.1. an operation handbook, containing at least

- the location of the warning labels
- warnings concerning the risks related to the use of the motorcycle and general safety recommendations
- the vehicle identification and location of the vehicle identification
- the location of the controls, instruments and equipment
- pre-start checks
- instructions on riding the motorcycle
- maintenance and periodic adjustments instructions
- cleaning and garaging instructions
- technical characteristics

#### 18.2. a pre-delivery certificate, containing at least

the dealer's declaration that:

- all inspections and adjustments have been carried out, in particular those concerning:
  - the presence of warnings
  - the battery

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<sup>1</sup> Directive 97/24/EC of the European Parliament and of the Council of 17 June 1997 on certain components and characteristics of two or three-wheel motor vehicles. Official Journal L 226 , 18/08/1997 P. 0001 - 0454

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- the oil/coolant levels
- the brakes/wheels/tires
- the chassis/accessories
- the electric equipment: lighting/safety
- start up/engine operation check
- the road test
- the final inspection/cleaning
- the motorcycle is in working order
- the purchaser has received:
  - the operation handbook
  - information concerning the possibilities for riding tuition.
- the purchaser has been informed of:
  - the risks and of the safety instructions
  - the need to follow riding tuition
  - the operation of the controls
  - the importance of reading the operation handbook
  - the importance of maintenance
  - the warranty conditions

the purchaser's declaration that:

- he/she has made himself/herself acquainted with:
  - the risks and the safety instructions;
  - the need to follow riding tuition;
  - the operation of the controls;
  - the importance of reading the operation handbook;
  - the importance of maintenance;
  - the warranty conditions.
- he/she has received the operation handbook

Annex 1

Braking: Test conditions

Independent brake system

Single brake control actuated

- A. Vehicle condition:
- (a) Laden (means the maximum permissible mass as stated by the vehicle manufacturer)
  - (b) Engine disconnected (except for motorcycles with automatic transmission or automatic clutch. In these cases, the tests shall be carried out under the normal operating conditions.)
- B. Test conditions and procedure:  
The test area must be level, dry and have a surface affording good adhesion
- (a) Initial brake temperature:  $\geq 55\text{ °C}$  and  $\leq 100\text{ °C}$ ;
  - (b) Test speed: 60 km/h or 0.9  $V_{max}$ , whichever is lower;
  - (c) Brake application: Each brake control actuated separately;
  - (d) Brake actuation force: (i) Hand control:  $\leq 200\text{ N}$   
(ii) Foot control:  $\leq 350\text{ N}$
  - (e) Number of stops: until the vehicle meets the performance requirements, with a maximum of 6 stops;
  - (f) For each stop, accelerate the vehicle to the test speed and then actuate the brake control under the conditions specified in this paragraph.

All brake controls actuated

- A. Vehicle condition:
- (a) Unladen (i.e. vehicle curb weight plus rider weight. Rider weight is 75kg unless otherwise specified by the manufacturer);
  - (b) Engine disconnected (except for motorcycles with automatic transmission or automatic clutch. In these cases, the tests shall be carried out under the normal operating conditions.)
- B. Test conditions and procedure:  
The test area must be level, dry and have a surface affording good adhesion
- (a) Initial brake temperature:  $\geq 55\text{ °C}$  and  $\leq 100\text{ °C}$ ;
  - (b) Test speed: 100 km/h or 0.9  $V_{max}$ , whichever is lower;
  - (c) Brake application: Simultaneous actuation of both brake controls;
  - (d) Brake actuation force: (i) Hand control:  $\leq 250\text{ N}$   
(ii) Foot control:  $\leq 400\text{ N}$
  - (e) Number of stops: until the vehicle meets the performance requirements, with a maximum of 6 stops;
  - (f) For each stop, accelerate the vehicle to the test speed and then actuate the brake controls under the conditions specified in this paragraph.

Combined brake system

Single brake control actuated:

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- A. Vehicle condition:
- (a) Laden (means the maximum mass stated by the vehicle manufacturer to be technically permissible);
  - (b) Engine disconnected (except for motorcycles with automatic transmission or automatic clutch. In these cases, the tests shall be carried out under the normal operating conditions.)
- B. Test conditions and procedure:  
The test area must be level, dry and have a surface affording good adhesion
- (a) Initial brake temperature:  $\geq 55\text{ °C}$  and  $\leq 100\text{ °C}$ ;
  - (b) Test speed: 60 km/h or 0.9  $V_{\max}$ , whichever is lower;
  - (c) Actuation of the single brake control (by hand or foot.) on all wheels;
  - (d) Brake actuation force:
    - (i) In the case of operation by hand:  $\leq 200\text{ N}$
    - (ii) In the case of operation by foot:  $\leq 350\text{ N}$
  - (e) Number of stops: until the vehicle meets the performance requirements, with a maximum of 6 stops;
  - (f) For each stop, accelerate the vehicle to the test speed and then actuate the brake control under the conditions specified in this paragraph.

All brake controls actuated:

- A. Vehicle condition:
- (a) Unladen (i.e. vehicle curb weight plus rider weight. Rider weight is 75kg unless otherwise specified by the manufacturer);
  - (b) Engine disconnected (except for motorcycles with automatic transmission or automatic clutch. In these cases, the tests shall be carried out under the normal operating conditions.)
- B. Test conditions and procedure:  
The test area must be level, dry and have a surface affording good adhesion
- (a) Initial brake temperature:  $\geq 55\text{ °C}$  and  $\leq 100\text{ °C}$ ;
  - (b) Test speed: 100 km/h or 0.9  $V_{\max}$ , whichever is lower;
  - (c) Brake application:  
Actuation of the all brake controls (by hand or foot.) on all wheels;
  - (d) Brake actuation force:
    - (i) In the case of operation by hand :  $\leq 250\text{ N}$
    - (ii) In the case of operation by Foot :  $\leq 400\text{ N}$
  - (e) Number of stops: until the vehicle meets the performance requirements, with a maximum of 6 stops;
  - (f) For each stop, accelerate the vehicle to the test speed and then actuate the brake controls under the conditions specified in this paragraph.

Annex 2

Stands: Test conditions and procedures

1. Test conditions

1.1. State of the motorcycle

- 1.1.1. The motorcycle must be submitted at its kerb mass.
- 1.1.2. The tyres must be inflated to a pressure recommended by their manufacturer for that state.
- 1.1.3. The transmission must be in neutral or, in the case of an automatic transmission, in the 'parking' position where such exists.
- 1.1.4. The steering shall be locked in position. If the steering is able to be locked when it is turned to either the left or the right the tests must be carried out in both positions.

1.2. Test pad

- 1.2.1. A flat, horizontal pad having a hard surface that is dry and free from grains of sand may be used for the tests referred to in section 2.1 of this Annex.

1.3. Test equipment

- 1.3.1. A parking platform must be used for the tests referred to in section 2.2 of this Annex.
- 1.3.2. The parking platform must have a rigid, flat, rectangular surface which is able to support the motorcycle without perceptible flexing.
- 1.3.3. The surface of the parking platform must possess sufficient anti-skid properties to prevent the motorcycle from sliding across the supporting surface during the tilt or lean tests.
- 1.3.4. The parking platform shall be designed in such a way as to be able to assume at least the transverse tilt (TT) and the longitudinal tilt (LT) required by section 2.2.2 of this Annex.

2. Test procedures

2.1. Stability on a horizontal supporting surface (see 4.2.1.1)

- 2.1.1. With the motorcycle on the test pad the prop stand is extended or moved into the parking position and the motorcycle is brought to rest upon it.
- 2.1.2. The motorcycle is moved in order to increase by three degrees the angle formed by the median longitudinal plane and the supporting surface (by moving the motorcycle towards the vertical).
- 2.1.3. This movement must not cause the prop stand to return automatically to its retracted or travelling position.

2.2. Stability on an inclined surface (see 4.2.1.2 and 4.2.1.3 and 4.2.2.1 to 4.2.2.3)

- 2.2.1. The motorcycle is placed on the parking platform with the prop stand and, separately, the centre stand in the extended or parking position and the motorcycle is allowed to rest on the stand.
- 2.2.2. The parking platform is shifted to its minimum transverse tilt (TT) and then separately, to its minimum longitudinal tilt (LT) in accordance with the following table:

Tilt	Prop Stand	Centre Stand
TT (left and right)	6%	8%
Downstream LT	6%	8%
Upstream LT	8%	14%

See Figures 1a, 1b and 2 below.

- 2.2.3. where a motorcycle on an tilted parking platform rests on the centre stand and just one wheel and may be maintained in that position with the centre stand and either the front or the rear wheel in contact with the supporting surface, the tests described

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above must be conducted solely with the motorcycle resting on the centre stand and rear wheel provided that the other requirements set out in this section are met.

2.2.4. The motorcycle must remain stable when the parking platform is tilted by each of the required amounts and the above requirements have duly been met.

2.2.5. Alternatively the parking platform may be tilted by the required amounts before the motorcycle is moved into position.

