

Mopeds and motorcycles – Speedometers – Methods of calibration

1. Scope

This standard establishes guidelines for methods used to calibrate speedometers and odometers that are attached to mopeds and motorcycles (hereinafter referred to as "motorcycles") undergoing driving tests, with such calibration being performed at the time of the driving test and utilizing values indicated by the speedometer and odometer.

2. Normative reference

The following standards, when referred to in this standard, constitute a part of the specifications of this standard. As required, the most recently updated version of the applicable reference standards (including addenda) shall be applied.

JIS D 5601 Speedometers for automobiles

3. Test conditions

Testing shall be performed with either a roller dynamometer or test road.

3.1 Test equipment

3.1.1 Roller dynamometer

- a) Tyres and rollers shall make contact at one point.
- b) The diameter of the roller shall be 0.4 m or larger.
- c) It shall be possible to operate the driving wheel of the test motorcycle's speedometer and odometer on the roller dynamometer's roller at any constant speed.
- d) Speed and travel distance display units shall be installed. Each display unit shall be calibrated and shall guarantee the required accuracy.
- e) Motorcycles shall be tested with one rider on board.
- f) Test motorcycles shall be set to minimize oscillation.

3.1.2 Test road

- a) The test road shall be even, horizontal, linear, dry, and paved.
- b) The speedometer calibration test road shall be of sufficient length to include an acceleration section (in which to achieve a stabilized test speed), measurement section, and stopping section. When an electronic or electric time measuring instrument is utilized, the measurement section shall be 2 meters in length. When a stopwatch is utilized for measuring, the distance shall generally be in the range of 100 to 200 meters.

In addition, the length of the measurement section shall set to within an error of $\pm 0.1\%$.
- c) The measurement section of the odometer calibration test road shall be of sufficient length to enable the wheels to turn several rotations.

- d) Weather conditions: The air temperature shall be within a range that will not affect the speedometer reading.
The wind speed and wind direction shall be within a range that will not affect the vehicle's operation.

3.2 Test motorcycle

The test motorcycle shall meet the following conditions:

- a) Loading conditions: The motorcycle shall be in unloaded condition¹⁾ and have one rider on board.

Note: ¹⁾

Motorcycle shall be equipped as necessary for operation, and shall contain the proper amount of fuel (at least 90% of the prescribed fuel capacity), lubricating oil, tools, and other necessities (excluding spare parts and other portable items).

- b) Tyre air pressure: 20 kPa shall be added to the cold type pressure prescribed by the motorcycle manufacturer.
- c) The engine, power transmission system, steering system, brake system, and other equipment shall have received proper maintenance ahead of time.

Note:

Information regarding maintenance performed by the motorcycle manufacturer shall be indicated in instruction manuals, maintenance manuals, etc.

3.3 Test equipment

Primary test equipment and equipment accuracy shall meet the following requirements:

- a) **Time measuring instrument** Use either of the instruments listed below. To minimize measurement errors, however, usage of an electronic or electric time measuring instrument is desirable.
Electronic or electric time measuring instrument: Scale interval shall be 0.0001 second or less.
Stopwatch: Scale interval shall be 0.01 second or less. Use at least three at the same time.
- b) **Length measuring instrument** Scale interval shall be 0.001 meter or less. When using a measuring tape or other length measuring instrument that is not electronic or electric, one that can measure at least 50 meters is desirable.

3.4 Driver weight and clothing

While on the test road, the driver's weight and clothing shall meet the following requirements:

- a) The driver's weight shall be 75 kg, including the weight of the driver and his/her protective gear (coveralls, helmet, boots, gloves, etc.).
- b) For bodily protection, the driver shall wear protective gear that fits the driver's body.

3.5 Driving posture

The driver shall assume the following posture when driving:

- a) Both hands shall grip the handlebar.
- b) Both legs shall be placed on the driver's footrests, footboards, or pedals.
- c) The driver shall be sitting on the seat.
- d) When driving, the driver's arms shall be slightly bent and shall not change as measurements are being taken.

4 Calibration method

4.1 Speedometer

Calibrations are performed using either a roller dynamometer or test road.

4.1.1 Calibration by roller dynamometer

Run the roller dynamometer such that the test motorcycle's speedometer reading indicates a constant speed. Measure the actual speed of the roller dynamometer at that time. Using equations (1) and (2), find the reading error and speedometer correction factor.²⁾ The test speed shall generally be in increments of 10 km/h starting from 20 km/h, and the measurement range shall be arbitrarily determined according to the conditions of the subject driving test.

Note: ²⁾

Ratio of actual speed to speedometer reading

$$\Delta V = V - V_o \dots\dots\dots (1)$$

$$C_v = \frac{V_o}{V} \dots\dots\dots (2)$$

Where ΔV : Speedometer reading error (km/h)
 V : Speedometer reading (km/h)
 V_o : Actual speed (km/h)
 C_v : Speedometer correction factor

4.1.2 Calibration by test road

With the test motorcycle's speedometer reading indicating a constant speed, drive through the measurement section and measure the time required for that. Find the actual speed from equation (3), and find the reading error and speedometer correction factor from equations (1) and (2) in 4.1.1.

The test speed shall generally be in increments of 10 km/h starting from 20 km/h, and the measurement range shall be arbitrarily determined according to the conditions of the subject driving test.

$$V_o = \frac{3.6 l}{t} \dots\dots\dots (3)$$

Where l : Distance of measurement section (m)
 t : Time required to drive through measurement section³⁾ (s)

Note: ³⁾

If measuring with a stopwatch, use the average of the values measured with each stopwatch. If, however, a measured value noticeably varies from the average, exclude that value and use the average of the remaining measurements.

4.2 Odometer

Calibrations are performed using either a roller dynamometer or test road.

4.2.1 Calibration by roller dynamometer

Run the roller dynamometer at an arbitrary constant speed, and measure the actual travel distance of the roller dynamometer required for the test motorcycle's odometer to accumulate an arbitrary distance. From equation (4), find the odometer correction factor.⁴⁾

In addition, take measurements about three times, and find the average value. Use that value when performing calculations.

The roller dynamometer's operating speed shall be arbitrarily determined according to the conditions of the subject driving test.

Also, it is recommended that the odometer's cumulative distance be at least 1 km.

Note: ⁴⁾

Ratio of actual travel distance to odometer reading

$$C_{LS} = \frac{L_o}{L} \dots\dots\dots (4)$$

Where C_{LS} : Odometer correction factor

L_o : Actual travel distance (m)

L : Odometer reading (m)

4.2.2 Calibration by test road

Run the odometer's driving wheel at low speed for an arbitrary number of rotations, and measure that travel distance. Using equation (5), find the wheel's effective diameter.

Next, measure the number of driving wheel rotations required for the test motorcycle's odometer to accumulate an arbitrary distance. Using equation (6), find the actual travel distance; then using equation (4), find the odometer's correction factor. At this time, raise the odometer's driving wheel upward from the ground by jacking or other method, and idle the wheels until the odometer accumulates an arbitrary distance.

Also, take measurements about three times and find the average value. Use that value when performing calculations.

In addition, the cumulative distance for the odometer's cumulative rotations measurement shall be equal to or greater than the odometer's minimum reading.

$$D = \frac{L_s}{\pi N_1} \dots\dots\dots (5)$$

$$L_o = \pi D N_2 \dots\dots\dots (6)$$