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Road vehicles — Measurement of opacity of exhaust gas from compression-ignition (diesel) engines — Lug-down test

Véhicules routiers — Mesure de l'opacité des gaz d'échappement des moteurs à allumage par compression (diesel) — Essai de décélération

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7644 was prepared by Technical Committee ISO/TC 22, *Road vehicles.*

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Road vehicles — Measurement of opacity of exhaust gas from compression-ignition (diesel) engines — Lug-down test

1 Scope

This International Standard specifies a test method for the measurement of exhaust gas opacity from compression-ignition (diesel-)engined vehicles. It describes the measurement of exhaust opacity under quasi-steady conditions during a lug-down at full load over the normal operating speed range of the engine.

NOTE — This method is most suitable as an inspection station test. The test method with a steady single speed specified in ISO 7645 is also well suited to an inspection station test, but may be used on the road.

2 Field of application

This International Standard applies to compression-ignition (diesel-)engined road vehicles. It is not intended to cover agricultural tractors and special vehicles for use in civil engineering.[1)]

3 Reference

ISO 3173, *Apparatus for measurement of the opacity of exhaust gas from diesel engines operating under steady state conditions.*

4 Definitions

For the purposes of this International Standard, the following definitions apply.

4.1 roadside test : Test which can easily be carried out with the vehicle stationary, using simple and easily transportable equipment.

4.2 road test : Test involving driving the vehicle on the road.

4.3 inspection station test : Test on a stationary vehicle, where the equipment may be more complex and permanently installed.

NOTE — Inspection station personnel may also carry out tests on roads (private or public).

5 Principle

Positioning the vehicle on a free-running roller assembly and, with the transmission engaged, measuring the exhaust opacity while the engine is kept at full load and the vehicle speed (roll speed) is reduced uniformly from 100 % to 40 % of maximum in about 10 s, by use of vehicle brakes on the drive axle(s).[2)]

6 Test equipment

6.1 Roller assembly

The roller assembly shall be capable of accepting single or tandem drive axles (laden up to 13 t per axle) with coupling of left and right rollers (if separate) on at least one pair of the rollers used for the drive axle(s).[3)]

Roller brakes or other suitable means shall be provided to facilitate removing the test vehicle from the roller assembly. The roll diameter shall not be less than 200 mm and the effective mass of the roller at the roll surface shall not be more than 150 kg, equivalent to a stored energy of approximately 20 kJ at 60 km/h surface speed of the rolls. The roller assembly need not be capable of absorbing power, i.e. it may consist of "free rollers".[4)]

6.2 Speed indicator

Means shall be provided for displaying the engine speed. The accuracy shall be within ± 60 r/min or ± 2 % of the engine speed, whichever is the greater. The response time shall be better than 0,5 s for 90 % of a step input and the linearity shall be better than 1 %.

1) This test has been developed for vehicles of more than 3,5 t G.V.M. since there is less experience with lighter vehicles. The test should be limited to conditions where the power torque at the drive axle is less than the available brake torque. (See ISO/TR 9310.)

2) For countries where regulations specify a speed range the lower limit of which is higher than 45 % of the runout, the speed range of the test and the evaluation may be adjusted accordingly.

3) It is preferable that left- and right-hand rollers are coupled to all drive axles.

4) If an adequately-sized absorption-type roller dynamometer is available, this may be used for absorbing the engine load instead of the vehicle brakes.

6.3 Indicator for excess deceleration and elapsed time

Means shall be provided for indicating when the deceleration and elapsed time are outside the limits specified in 8.4.

6.4 Opacimeter and installation

6.4.1 Opacimeter

The opacimeter shall conform to ISO 3173, except that its physical response shall be better than 0,5 s. The combined response of the opacimeter and sampling system shall not exceed 1 s.

6.4.2 Installation

The installation of the opacimeter shall conform to ISO 3173 and to the manufacturer's instructions.

6.5 Recorder

Where it is desired to record the vehicle exhaust gas emission during the test, the recorder shall meet the following specifications :

Linearity : ± 1 % (max.) of f.s.d. (full scale deflection)

Dead band : < 0,2 % of f.s.d.

Response time : < 0,5 s for 90 % of a step input

Damping : overshoot 2 % max.

7 Test preparation

7.1 Equipment calibration

7.1.1 Opacimeter

The opacimeter shall be calibrated in accordance with the manufacturer's instructions (see ISO 3173).

7.1.2 Recorder (where used)

The zero span controls shall be set so that the 0 and 100 % speed and obscuration signals on the recorder agree with the corresponding roll indicator and opacimeter readings.

7.2 Vehicle preparation

7.2.1 Tyres

Tyres used for the test shall be undamaged and shall be inflated to the normally recommended pressure.

7.2.2 Engine

The engine shall be at normal operating temperature, e.g. after a road run or a dynamic test.

7.2.3 Exhaust system

The exhaust system shall not have any holes through which the gases emitted by the engine might be diluted.

7.2.4 Brakes — Load conditions

For vehicles with brake regulators actuated by load sensing, it may be necessary to disconnect the load-sensing device or test the vehicle in a partly laden condition.

8 Test method

8.1 Set the vehicle on the free-running rollers, taking the following precautions :

— the drive axle wheels shall be cradled securely in the roller assembly;

— lateral restraint shall be provided for front-wheel-drive vehicles;

— drive axles which are not on the rollers shall be disengaged.

8.2 Connect the opacimeter to the vehicle exhaust in accordance with the opacimeter manufacturer's instructions.

8.3 Bring the engine to maximum governed speed by fully depressing the accelerator. The gear selected should give a roller speed corresponding to a road speed of 50 to 70 km/h for trucks, and 50 to 80 km/h for passenger cars and light-duty vehicles (i.e. vehicles of less than 3,5 t G.V.M.) unless prevented by consideration of vehicle maximum speed or brake capacity as may be specified by the vehicle manufacturer.

8.4 Apply the vehicle service brakes gradually whilst keeping the accelerator fully depressed so that the engine speed is lugged down with a deceleration as uniform as possible, but not greater than 15 % per second of the maximum speed, so that 40 % speed is reached in about 10 s (8 to 15 s).[1)]

8.5 At about 40 % of maximum speed, release the brakes and accelerator and run the vehicle at that speed (with the brakes off) for a period of 30 s to allow the brakes to cool.

8.6 During the test, plot the engine speed and the exhaust gas opacity. (The exhaust gas opacity shall be measured in accordance with the opacimeter manufacturer's instructions.)

1) For countries where regulations specify a speed range the lower limit of which is higher than 45 % of the runout, the speed range of the test and the evaluation may be adjusted accordingly.