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Road vehicles — Localization of exhaust system leaks and equipment specifications

Véhicules routiers — Localisation des fuites de la ligne d'échappement et spécifications de l'équipement

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.

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.

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Road vehicles — Localization of exhaust system leaks and equipment specifications

1 Scope

This International Standard specifies a method to verify the gas tightness of the exhaust system of road vehicles equipped with an international combustion engine.

It is primarily intended to establish a method to detect and localize exhaust system leaks in order to improve the quality of exhaust gas measurements. It is also intended to complete the requirements of ISO 3929[1)] and applicable regulations.

The users of this International Standard are warned that:

a) certain engines with high valve overlaps camshaft events, especially engines with eight or more cylinders, may not have all exhaust valves closed when the engine is stopped. This issue may cause the leak test to fail. This situation could be corrected by the disassembly of the exhaust valve actuation mechanism using the vehicle or engine manufacturer's recommended procedure;

b) national regulations on the subject of pressurizing should be checked before testing;

c) detected leakage can be quantified under certain test conditions.

This International Standard also specifies the measurement apparatus and necessary devices.

This method is particularly recommended for:

a) automotive workshops,

b) laboratories before any emission tests,

c) testing and diagnostic stations.

The measurement apparatus can be used at the end of line of automotive and exhaust parts manufacturers.

2 Definitions

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

2.1
exhaust system
all parts between the joint face between the manifold to cylinder head and the outlet pipe(s)

2.2
leaks
all outward exhaust gas flow or inward air flow which can affect the exhaust emission measurement results

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1) ISO 3929:1995, *Road vehicles — Measurement methods for exhaust gas emissions produced during inspection or maintenance*.

2.3
ultrasound
vibration which generates acoustic pressure within the frequency range 20 kHz to 100 kHz

2.4
measuring head
device designed to protect the microphone against a direct warm air flow and to facilitate leak localization and measurement (see figure 2)

2.5
pressurization system
system used to keep the exhaust system at a required pressure (see 3.1)

3 Apparatus

3.1 Pressurization system, in accordance with figure 1, comprised of

— an air supply device capable of maintaining a pressure of 0,4 bar (40 kPa). The air supply shall be clean and water- and oil-free;

— a pressure adjusting device;

— a calibrated leak with a 1 mm diameter;

— a 0 to 1 bar (100 kPa) manometer having an accuracy of ± 2 %, to be periodically checked;

— a flexible leak-proof adapter for the exhaust system outlet, usable up to 200 °C. The connecting device shall be adaptable to the exhaust outlet(s) and may be an adapter inserted into the exhaust outlet(s).

3.2 Ultrasonic equipment, comprised of

— a probe with an adapter, called a "measuring head", in a accordance with figure 2 and easy to handle;

— an ultrasound receiver (microphone), for which the microphone temperature shall not be greater than its operating temperature when the measuring head is exposed to a contact temperature equal to 300 °C at area D1 and line D2 for at least 30 s (see figure 2);

— an ultrasound processing device. This device converts the detected ultrasounds within the bandwidth of 30 kHz to 50 kHz into audible sounds proportional to the sound pressure. The device shall comply with the calibration curve shown in figure 3;

— a leak indicator, which shall give a rough indication of the leak flow rate corresponding to a theoretical circular hole leak. It shall only display the following numerical indications:

∅ 2 mm, corresponding to (30 ± 5) l/min,
∅ 1,5 mm, corresponding to (17 ± 3) l/min,
∅ 1 mm, corresponding to (7,5 ± 1,5) l/min,
∅ 0,5 mm, corresponding to (2 ± 1) l/min.

An example of such an indicating device is given in figure 4;

— a temperature warning device, if necessary;

— a low battery warning;

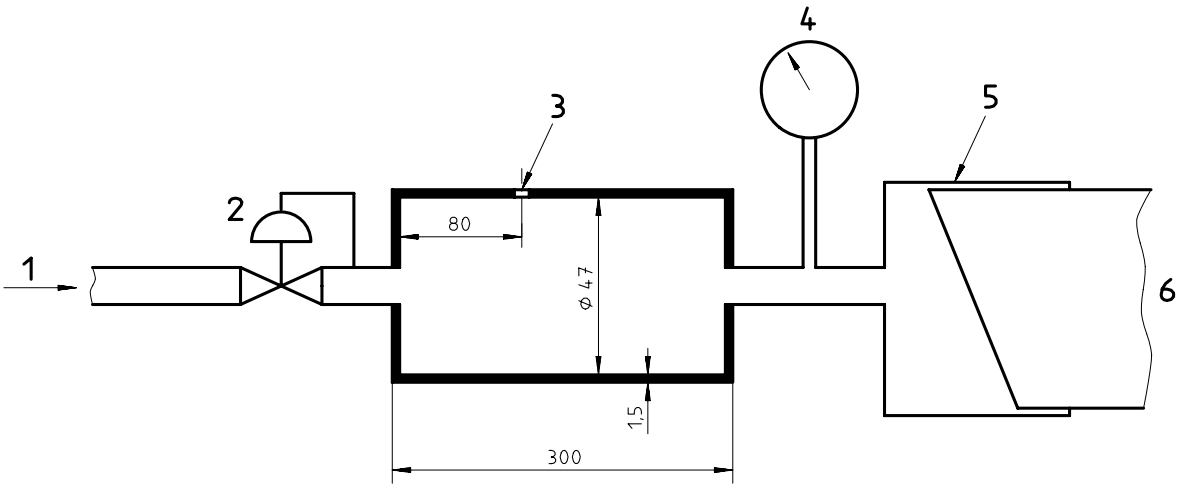
— headphones or equivalent device;

— all accessories needed to perform the test and its verification;

Periodic checking shall be performed according to the manufacturer's specifications.

3.3 Verification system, in accordance with figure 5.

Dimensions in millimetres

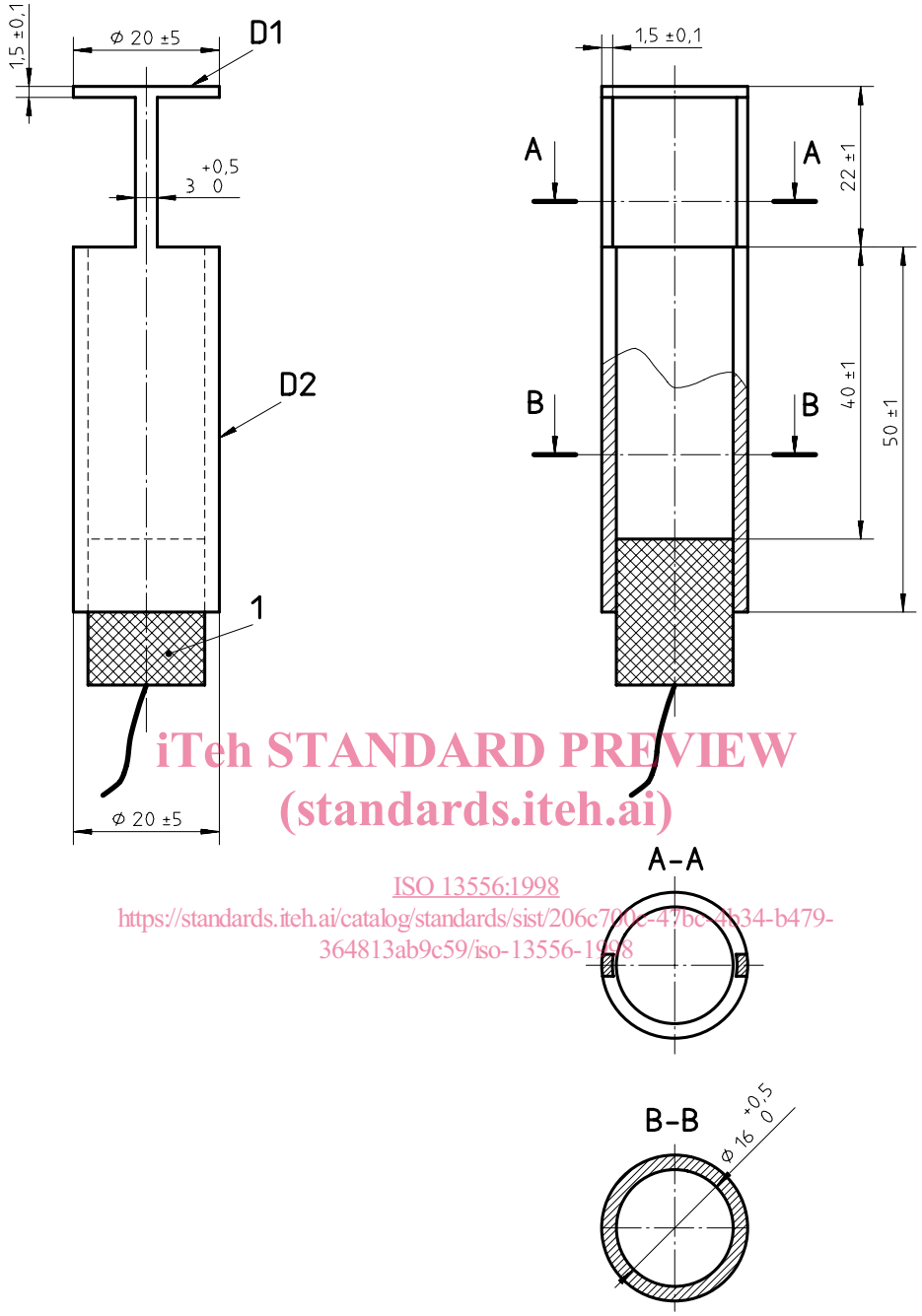


Key

1 Pressurized air supply
2 Pressure regulator
3 Calibrated leak with 1 mm diameter
4 Manometer
5 Leak-proof adapter (connecting device)
6 Exhaust pipe outlet

Figure 1 — Pressurization system

Dimensions in millimetres



Key

1 Microphone
D1 see 3.2
D2 see 3.2

Figure 2 — Measuring head

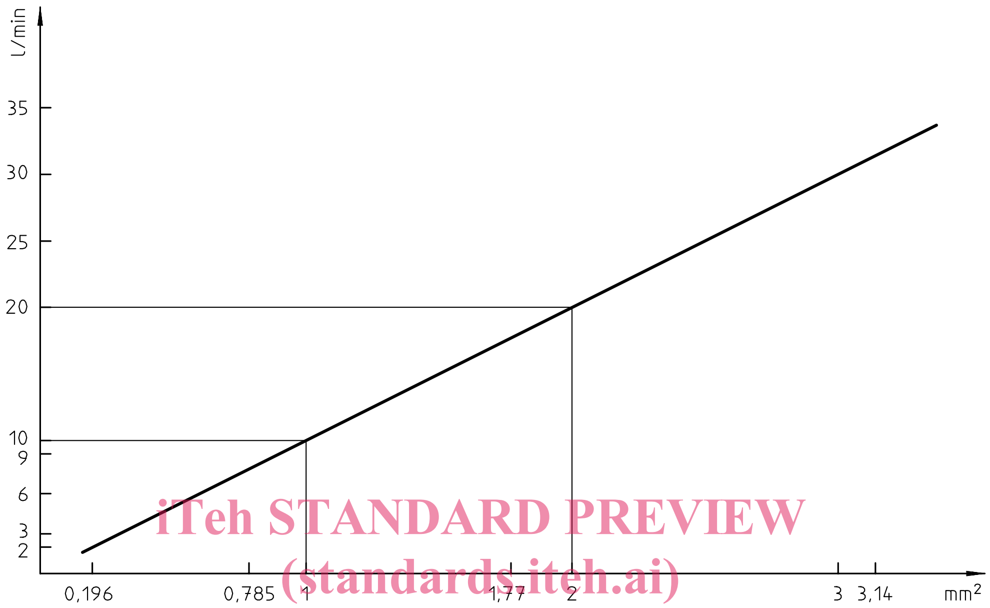


Figure 3 — Calibration curve

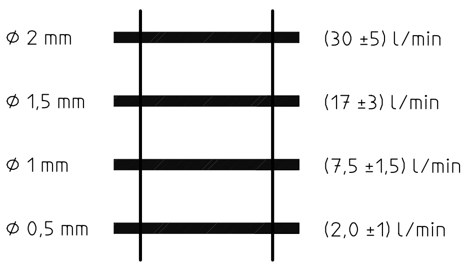
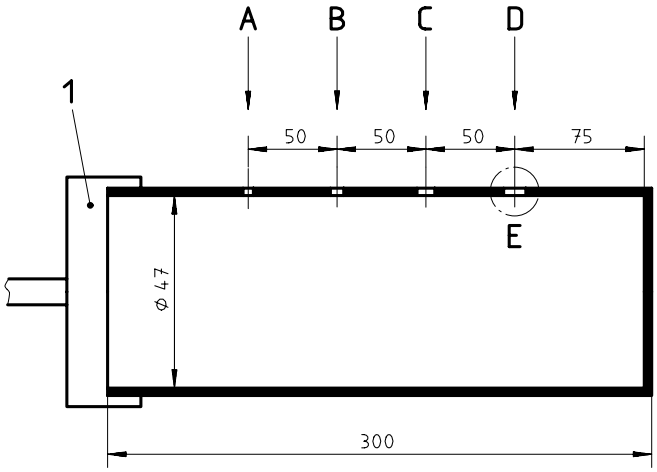
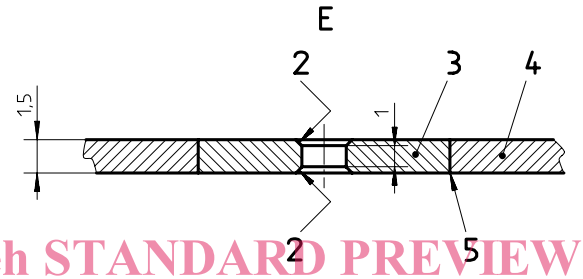


Figure 4 — Leak indicator

Dimensions in millimetres





Key

1 Pressurization system
2 Chamfer 0,25 mm at 45°
3 Tap
4 Air reservoir wall
5 Leak tight joint

Check point	Diameter of the calibrated leak	Leak flow rate
ISO 13556:1998	mm	l/min
A	0,5	2,0 ± 1
B	1	7,5 ± 1,5
C	1,5	17 ± 3
D	2	30 ± 5

Figure 5 — Verification system for the ultrasonic equipment

4 Verification of ultrasonic equipment

Install the pressurization system on the verification system, in accordance with figure 5.

Plug calibrated leaks B, C and D.

Pressurize to 0,4 bar $^{+0,05}_{0}$ bar (40 kPa $^{+5}_{0}$ kPa), checking that the pressure remains constant for all check points.

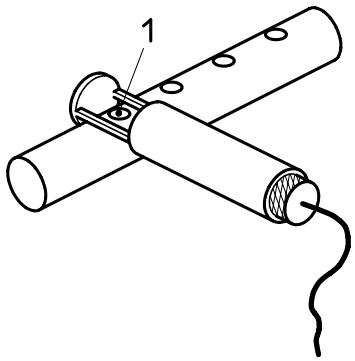
Install the measuring head in accordance with figure 6.

Measure the leak A using the ultrasonic equipment.

Compare the measured leak flow rate with the flow rate specified in the table in figure 5 for the relevant check point.

Plug leaks A, C and D and repeat the above procedure; do the same with leaks A, B and D plugged, and then with leaks A, B and C plugged.

If necessary, adjust the equipment according to the manufacturer's instructions.



Key

1 Calibrated leak

Figure 6 — Measuring head position

5 Test conditions

6 Test procedure

6.1 General

6.1.1 For systems with multiple outlets, each outlet shall be pressurized separately. The outlets not pressurized shall be plugged.

6.1.2 Install the pressurization device at the outlet of the exhaust pipe as indicated in figure 1.

6.1.3 Pressurize the exhaust system to 0,4 bar $^{+0,05}_{0}$ bar (40 kPa $^{+5}_{0}$ kPa).

6.1.4 Before starting the tests 6.3 and 6.4, check that the ultrasonic equipment is acceptable using the 1 mm diameter calibrated leak of the pressurization system, as indicated in figure 1. If not, check the apparatus, beginning with the manometer.

6.2 First test — Leak(s) that the operator can detect and localize without apparatus

Detect and localize the leak.

Repair the defective part(s) according to the vehicle manufacturer's instructions.

After repair, apply the test method described in 6.3, taking into account the flow limits specified by current regulations or vehicle manufacturers' specifications.