

KES

Testing Method of
Air Cleaners for Automobiles

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1. Scope of Application

This standard shall specify a testing method for performance of an oil-tank-type, a wet-type, a dry-type and their multistage air cleaner box (Air clean box hereinafter).

2. Definition of Terminology

Definitions for important terminologies used in this standard are following.

2.1 Rated air flow rate

It means a maximum air flow rate of a designated air clean box, which is an amount converted to the standard condition (Temperature 20 °C, atmospheric pressure 760 mmHg, humidity 65 %), and is expressed in m^3 / min .

2.2 Ventilation resistance

It is an absolute value of a difference between pressures at an entrance and an exit of an air cleaner, and is expressed in mmAq.

2.3 Rate of oil loss

It is a rate between amounts of oil, which is mixed in an air, leaves from the oil-tank-type and the wet-type air cleaner boxes, and the initial amount of oil, and is expressed in percentage.

2.4 Amount of air at the limit of oil loss

It is an amount of air when the oil loss reaches at 1 % due to an increase of the amount of the air.

2.5 Adhesion of oil on a filter

It is a condition that the oil sticks on whole surface at the bottom of the filter by an increase of the amount of air in the oil tank, and is expressed in the amount of the air at this time.

2.6 Cleanness efficiency

It is a ratio between an amount of dusts collected by the air cleaner box and an amount of supplied dusts, which is expressed in percentage.

2.7 Initial cleanness efficiency

It is the cleanness efficiency, measured by supplying prescribed dusts to the air cleaner.

2.8 Leveled cleanness efficiency

It is the cleanness efficiency, measured until the ventilation resistance has reached to a designated value.

2.9 Collected amount of dusts

It is the amount of dusts collected by the air cleaner box until the ventilation resistance has reached to a designated value.

2.10 Stability

It is a ratio between the ventilation resistance after cleaning the tested air cleaner box and the ventilation resistance before the test, and is expressed in percentage.

3. Test Item

Test on the following test items.

3.1 Ventilation resistance test

3.2 Oil loss test

3.2.1 Measurement of amount of air at the limit of oil loss

(1) Horizontal drive

(2) Slope drive

3.2.2 Measurement of amount of oil loss

(Applied only to the oil-tank-type and the wet-type air cleaner boxes)

3.3 Adhesion of oil on a filter test (Applied only to the oil-tank-type air cleaner box)

3.4 Cleanness efficiency test

3.4.1 Prescribed amount of air

(1) Initial cleanness efficiency

(2) Level cleanness efficiency

3.4.2 Changed amount of air

3.5 Dust collection test

3.6 Stability test

3.7 Leakage test

3.8 Breakage and crush test

4. Apparatus

For the apparatus, principally follow indications in Figure 1.

- (1) Use a ventilation device, which has a capacity of more than 125 % of the rated air flow rate of the testing air cleaner box at the testing conditions and is able to control the air flow rate properly. However, it is allowed to use an appropriate wind pipe.
- (2) For a flow meter, use an orifice or a nozzle, and it should be able to measure at least 125 % of the rated air flow rate of the air cleaner box.
- (3) For a measurement of a pressure difference between the ventilation resistance and the flow meter, use V-shaped manometer and the V-shaped manometer utilizes water for its liquid. However, the specific gravity of water shall be 1 at the temperature 0 ~ 40 °C.
- (4) For the thermometer, use a mercury or an alcohol thermometer, which has a scale mark below -1 °C.
- (5) A standard filter shall be made of several layers of fiber glass, and use it after putting inside an appropriate container.

Fiber glass shall be the fiber, which diameter of 0.8 ~ 1.3 μ and is thermosetting treated, and has thickness of about 13mm, specific gravity of about 0.01, absorption rate, which change of weight is less than 1 % after 96 hours of atmosphere at 50 °C of temperature

and 95 % of humidity, and a side where hairs have risen shall be the side that the air flows.

The size of the standard filter shall be large enough to perform the cleanness efficiency test, and the velocity of air that passes it shall be less than 0.3 m / sec.

- (6) The dust-supplying device shall be the one that can continuously supply the dusts, which is in a specified dust-mixture rate without changing diameters of particles, and its example is shown in Figure 2.
- (7) When performing the cleanness efficiency test for a full circumference-inhalation air cleaner box, the air cleaner box may be put in a box, and supply the dusts into that box, but it shall be shaped so that it is easy to measure the weight of the dusts left in the box.
- (8) The scales shall have enough capacity, and be able to correctly measure the dusts or the filter to 0.01 g scale, the air cleaner box, which weighs less than 5 kg, to 0.1 g scale, the air cleaner box, which weighs less than 10 kg, to 0.2 g scale, and the air cleaner box, which weighs more than 10 kg, to 0.5 g scale.

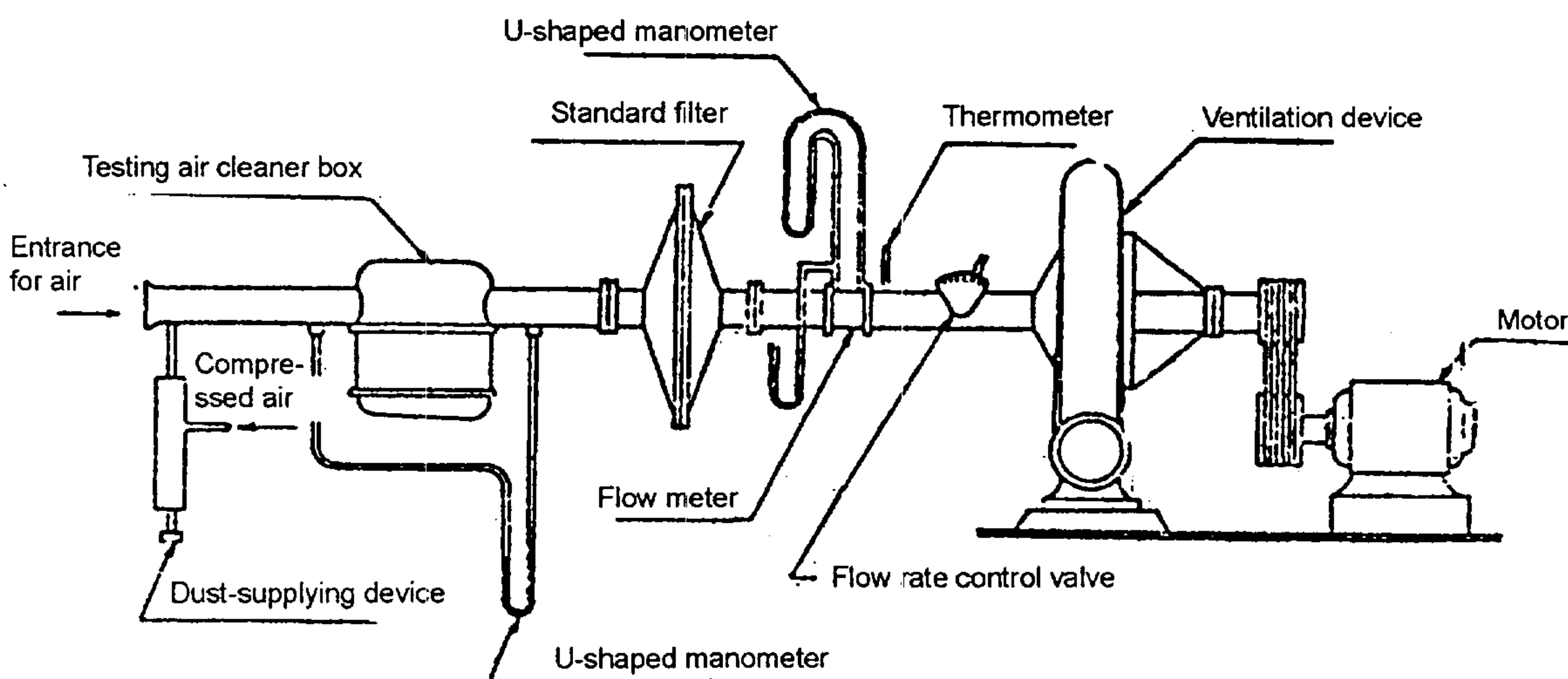


Figure 1. Summary of apparatus

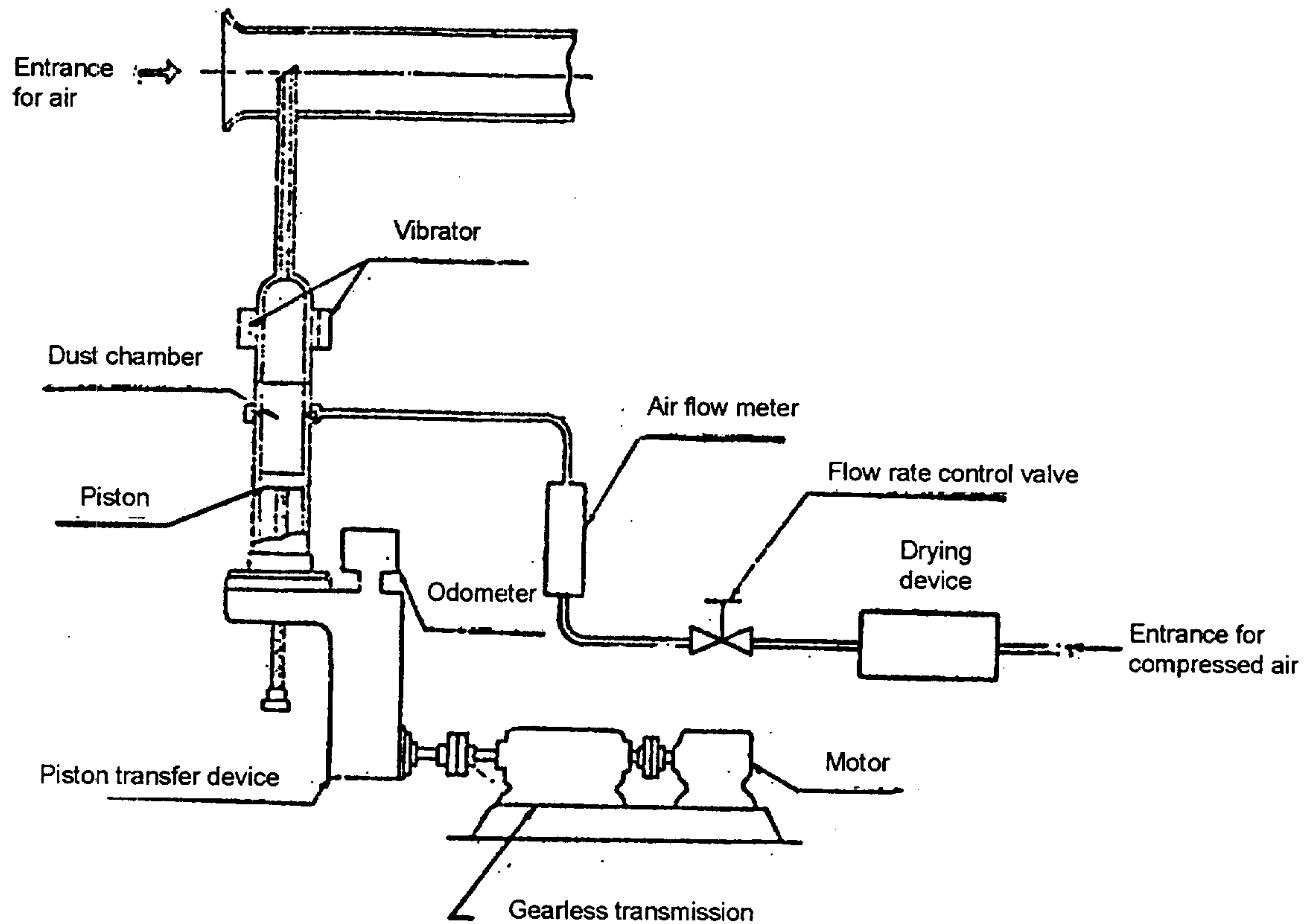


Figure 2. Summary of dust-supplying device

5. Testing Dusts

For the testing dusts, principally use class 7 or class 8 testing dusts.

6. Testing Oil

For an oil used for the oil-tank-type air cleaner box, use class 1, number 3 standard oil of KS M 2121, and follow the table 1 for its dynamic viscosity constant at the room temperature.

Table 1

Test item	Dynamic viscosity constant of oil cSt
Ventilation resistance	210 ~ 260
Oil loss	60 ~ 80

Table 1 (Continued)

Test item	Dynamic viscosity constant of oil cSt
Adhesion of oil on filter	210 ~ 260
Cleanness efficiency	210 ~ 260
Collected amount of dusts	210 ~ 260
Stability	210 ~ 260

7. Standby Condition of Laboratory

For the standby condition, measure the pressure, the temperature, and the humidity of the laboratory before and after each test.

8. Testing Method

For the air cleaner box, prepare the preparations in Table 2 when performing the test.

Table 2

Preparation Items Types of air cleaner box	(1) Clean the air cleaner box and dry	(2) Fill the testing oil up to a designated surface of the oil-tank-type	(3) Make the condition of a designated adhesion of oil for the air cleaner box	(4) Ventilate at the rated air flow rate for 10 minutes	(5) Stop the ventilation and leave for 15 minutes
Oil-tank-type	O	O	—	O	O
Wet-type	O	—	O	—	—
Dry-type	O	—	—	—	—

- Remark 1. O mark indicates a pertinent item.
2. When performing the oil loss test and the adhesion of the oil on a filter test, skip steps (1) and (5).
3. For the dry-type, use new element product for each test.

8.1 Ventilation resistance test

8.1.1 For the measurement of ventilation resistance of the air cleaner box assembly, use an adherence plate shown in Figure 3, attach the air cleaner as shown in Figure 4 for 100 %, 80 %, 60 %, 40 % and 20 % of the rated air flow rate according to the shape of the air cleaner box, and measure the constant pressure at point A.

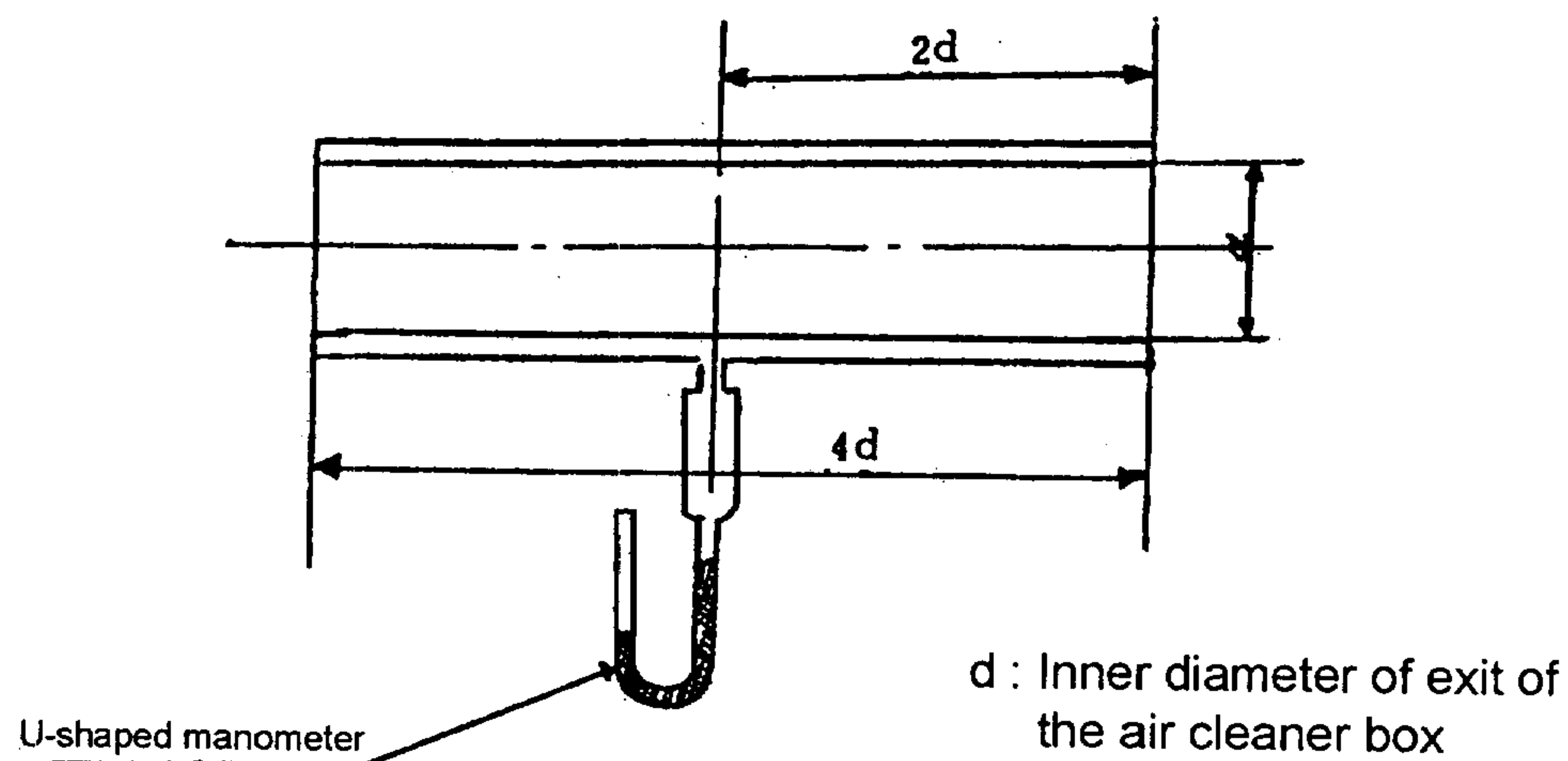


Figure 3. Adherence plate for exit of air cleaner box

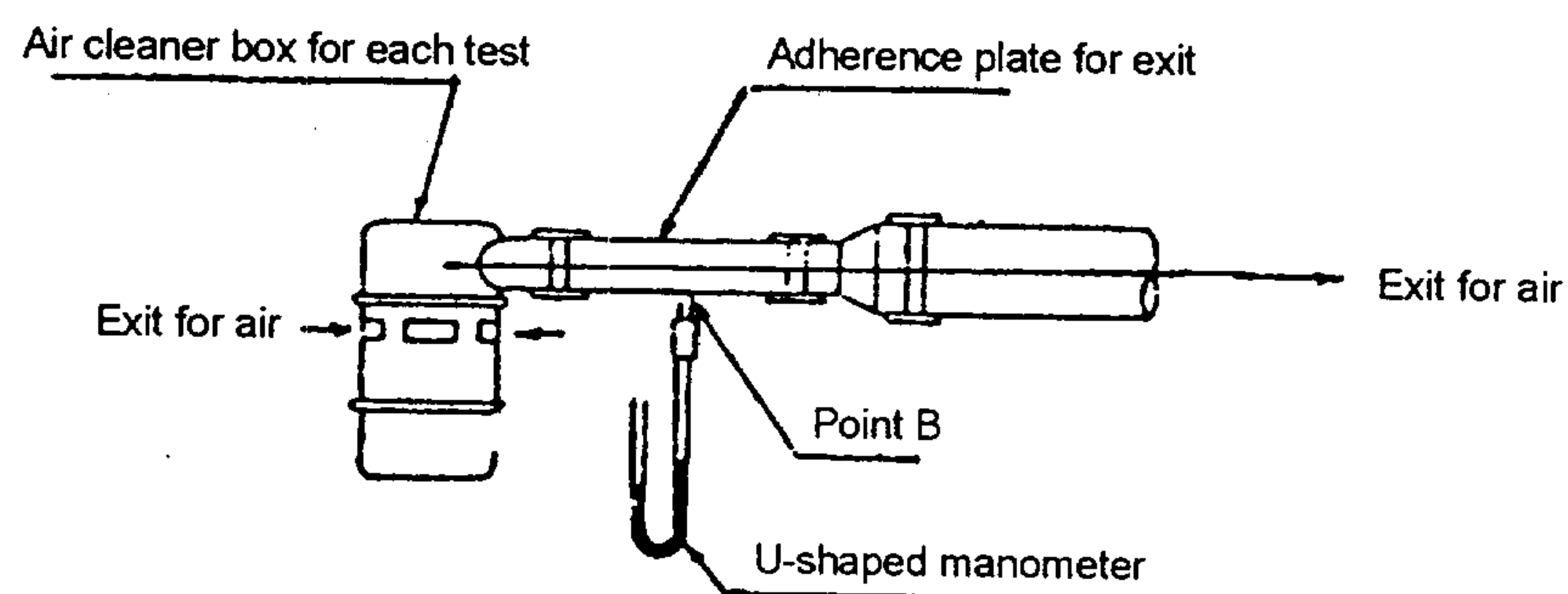


Figure 4. Adhesion method for full circumference-inhalation air cleaner box

8.1.2 Element

Follow the following for the ventilation resistance of the dry-type element.