

# ECE No. 51

## NOISE

### Annex 5

#### EXHAUST SYSTEMS CONTAINING FIBROUS MATERIALS

1. Fibrous materials shall not be used in the construction of silencers unless suitable measures are undertaken at the design or production stages to ensure that the efficiency required to comply with the limits imposed in paragraph 6.2.2. of this Regulation is achieved on the road. Such a silencer shall be considered to be efficient on the road if the exhaust gases are not in contact with the fibrous materials or if the silencer of the prototype vehicle tested in accordance with the requirements of paragraphs 3.1. and 3.2. of this Regulation has been put into a normal state for road use before the sound-level measurements are taken. This can be achieved by using one of the three tests described in paragraphs 1.1., 1.2. and 1.3. below or by removing the fibrous materials from the silencer.
  - 1.1. Continuous road operation for 10,000 km
    - 1.1.1. About half this operation consists of town driving and the other half of long-distance runs at high speed; continuous road operation can be replaced by a corresponding test-track programme.
    - 1.1.2. The two speed regimes should be alternated on several occasions.
    - 1.1.3. The complete test programme must include a minimum of 10 breaks of at least three hours duration in order to reproduce the effects of cooling and any condensation which may occur.
  - 1.2. Conditioning on a test bench
    - 1.2.1. Using standard parts and observing the vehicle manufacturer's instructions, the exhaust system or components thereof must be fitted to the vehicle referred to in paragraph 3.3. of this Regulation or the engine referred to in paragraph 3.4. of this Regulation. In the former case the vehicle must be mounted on a roller dynamometer. In the second case, the engine must be coupled to a dynamometer.
    - 1.2.2. The test must be conducted in six six-hour periods with a break of at least 12 hours between each period in order to reproduce the effects of cooling any condensation which may occur.
    - 1.2.3. During each six-hour period, the engine shall be run, under the following conditions in turn:
      - (1) Five minutes at idling speed;
      - (2) One-hour sequence under 1/4 load at 3/4 of rated maximum speed (S);
      - (3) One-hour sequence under 1/2 load at 3/4 of rated maximum speed (S);
      - (4) 10-minute sequence under full load at 3/4 of rated maximum speed (S);
      - (5) 15-minute sequence under 1/2 load at rated maximum speed (S);
      - (6) 30-minute sequence under 1/4 load at rated maximum speed (S);Total duration of the six sequences: three hours.  
Each period must comprise two sets of the six above-mentioned sequences.
    - 1.2.4. During the test, the silencer must not be cooled by a forced draught simulating normal

airflow around the vehicle. Nevertheless, at the request of the manufacturer, the silencer may be cooled in order not to exceed the temperature recorded at its inlet when the vehicle is running at maximum speed.

1.3. Conditioning by pulsation

1.3.1. The exhaust system or components thereof must be fitted to the vehicle referred to in paragraph 3.3. of this Regulation or the engine referred to in paragraph 3.4. of this Regulation. In the former case the vehicle must be mounted on a roller dynamometer.

In the second case, the engine must be mounted on a dynamometer. The test apparatus, a detailed diagram of which is shown in Figure 3 of the appendix to this annex must be fitted at the outlet of the exhaust system. Any other apparatus providing equivalent results is acceptable.

1.3.2. The test apparatus must be adjusted in a such a way that the exhaust-gas flow is alternatively interrupted and re-established by the quick-action valve for 2,500 cycles.

1.3.3. The valve must open when the exhaust-gas back pressure, measured at least 100 mm downstream of the intake flange, reaches a value of between 0.35 and 0.40 bar. It must close when this pressure does not differ by more than 10 % from its stabilized value with the valve open.

1.3.4. The time-delay switch shall be set for the duration of gas exhaust resulting from the provisions laid down in paragraph 1.3.3. above.

1.3.5. Engine speed must be 75% of the speed (S) at which the engine develops maximum power.

1.3.6. The power indicated by the dynamometer must be 50 % of the full-throttle power measured at 75% of engine speed (S).

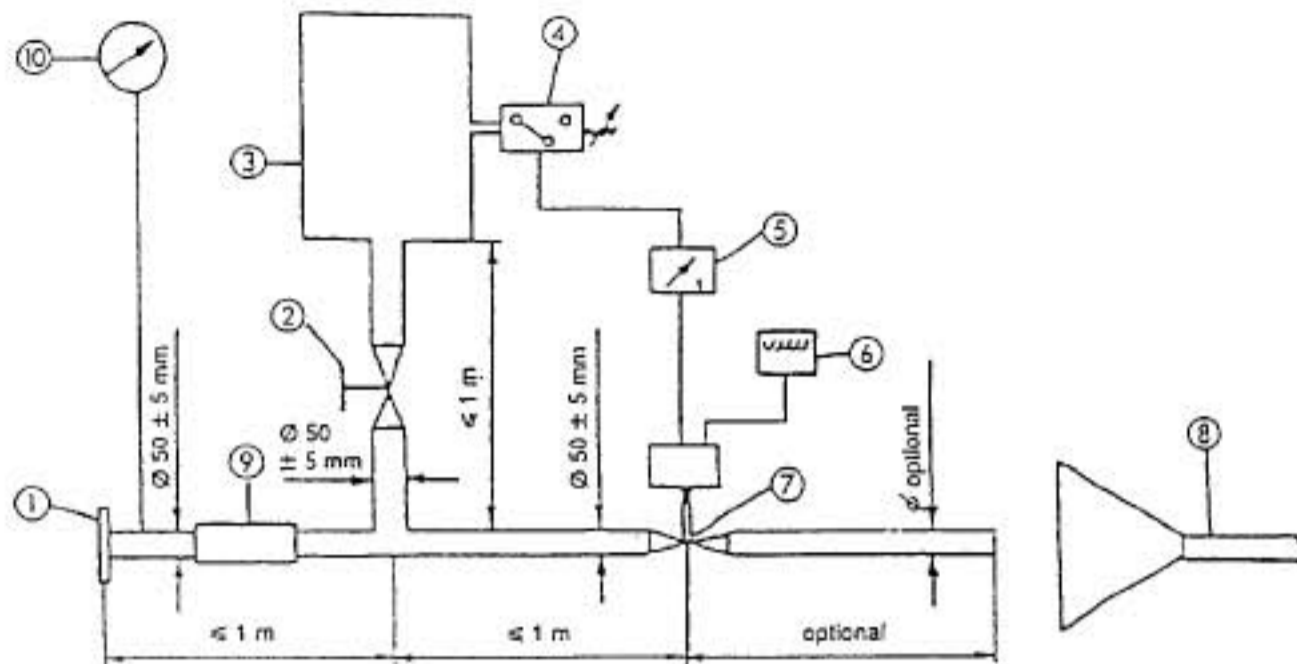
1.3.7. Any drainholes must be closed off during the test.

1.3.8. The entire test must be completed within 48 hours.

If necessary, one cooling period will be observed after each hour.

## Annex 5 - Appendix

Figure 3 Test apparatus for conditioning by pulsation



1. Inlet flange or sleeve for connection to the rear of the test exhaust system.
2. Hand-operated regulating valve.
3. Compensating reservoir with a maximum capacity of 40 l and filling time of not less than one second.
4. Pressure switch with an operating range of 0.05 to 2.5 bar.
5. Time delay switch.
6. Pulse counter.
7. Quick-acting valve, such as exhaust brake valve 60 mm in diameter, operated by a pneumatic cylinder with an output of 120 N at 4 bar. The response time, both when opening and closing, must not exceed 0.5 second.
8. Exhaust gas evacuation.
9. Flexible pipe.
10. Pressure gauge.