

# ECE No. 41

## NOISE (MOTOR CYCLE)

### Annex 5

#### EXHAUST SYSTEM (SILENCER)

1. Fibrous absorbent material must be asbestos-free and may be used in the construction of silencers only if suitable devices ensure that the fibrous material is kept in place for the whole time that the silencer is being used and it meets the requirements of any one of paragraphs 1.1., 1.2. and 1.3.
  - 1.1. After removal of the fibrous material, the sound level must comply with the requirements of annex 3 and the sound level limits of annex 4.
  - 1.2. The fibrous absorbent material may not be placed in those parts of the silencer through which the exhaust gases pass and must comply with the following requirements:
    - 1.2.1. The material must be heated at a temperature of 650 +/- 5 degrees C for four hours in a furnace without reduction in every length, diameter or bulk density of the fibre.
    - 1.2.2. After heating at 650 +/- 5 degrees C for one hour in a furnace, at least 98% of the material must be retained in a sieve of nominal aperture size 250 micrometres complying with ISO Standard 3310/1 : 1990 when tested in accordance with ISO Standard 2599 : 1983.
    - 1.2.3. The loss in weight of the material must not exceed 10.5% after soaking for 24 hours at 90 +/- 5 degrees C in a synthetic condensate of the following composition:  
 1 N hydrobromic acid (HBr): 10 ml  
 1 N sulphuric acid (H<sub>2</sub>SO<sub>4</sub>): 10 ml  
 Distilled water to make up to 1,000 ml.  
Note: The material must be washed in distilled water and dried for one hour at 105 degrees C before weighing.
  - 1.3. Before the system is tested in accordance with annex 3, it must be put into a normal state for road use by one of the following condition methods:
    - 1.3.1. **CONDITIONING BY CONTINUOUS ROAD OPERATION**
      - 1.3.1.1. According to the classes of motor cycles, the minimum distances to be completed during conditioning are:

| Class of motor cycle according to cylinder capacity in cm <sup>3</sup> | Distance (km) |
|--|---------------|
| Class I ≤ 80   | 4,000         |
| Class II > 80 ≤ 175  | 6,000         |
| Class III > 175  | 8,000         |

- 1.3.1.2. 50 +/- 10% of this conditioning cycle consists of town driving and the remainder of long-distance runs at high speed; the continuous road cycle may be replaced by a corresponding test-track programme.
- 1.3.1.3. The two speed regimes must be alternated at least six times.
- 1.3.1.4. 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 condensation.



1.3.2.                   CONDITIONING BY PULSATION

- 1.3.2.1.               The exhaust system or components thereof must be fitted to the motor cycle or to the engine. In the former case, the motor cycle must be mounted on a test bench. The test apparatus, a detailed diagram of which is shown in Figure 1, is fitted at the outlet of the exhaust system. Any other apparatus providing equivalent results is acceptable.
- 1.3.2.2.               The test equipment must be adjusted so that the flow of exhaust gases is alternatively interrupted and restored 2,500 times by a rapid-action valve.
- 1.3.2.3.               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. Should such a figure be unattainable because of the engine characteristics, the valve must open when the gas back-pressure reaches a level equivalent to 90% of the maximum that can be measured before the engine stops. It must close when this pressure does not differ by more than 10% from its stabilized value with the valve open.
- 1.3.2.4.               The time-delay switch must be set for the duration of exhaust gases calculated on the basis of the requirements of paragraph 1.3.2.3.
- 1.3.2.5.               Engine speed must be 75% of the speed (S) at which the engine develops maximum power.
- 1.3.2.6.               The power indicated by the dynamometer must be 50% of the full-throttle power measured at 75% of engine speed (S).
- 1.3.2.7.               Any drainage holes must be closed off during the test.
- 1.3.2.8.               The entire test must be complete within 48 hours. If necessary, a cooling period must be allowed after each hour.

1.3.3.                   CONDITIONING ON A TEST BENCH

- 1.3.3.1.               The exhaust system must be fitted to an engine representative of the type fitted to the motor cycle for which the exhaust system was designed, and mounted on a test bench.
- 1.3.3.2.               Conditioning consists of the specific number of test bench cycles for each class of motor cycle for which the exhaust system was designed. The number of cycles for each class of motor cycle is:

| Class of motor cycle according to cylinder capacity in cm <sup>3</sup> | Number of cycles |
|--|------------------|
| Class I $\leq 80$  | 6                |
| Class II $> 80 \leq 175$   | 9                |
| Class III $> 175$  | 12               |

- 1.3.3.3.               Each test-bench cycle must be followed by a break of at least six hours in order to reproduce the effects of cooling and condensation.
- 1.3.3.4.               Each test-bench cycle consists of six phases. The engine conditions for and the duration of each phase are:

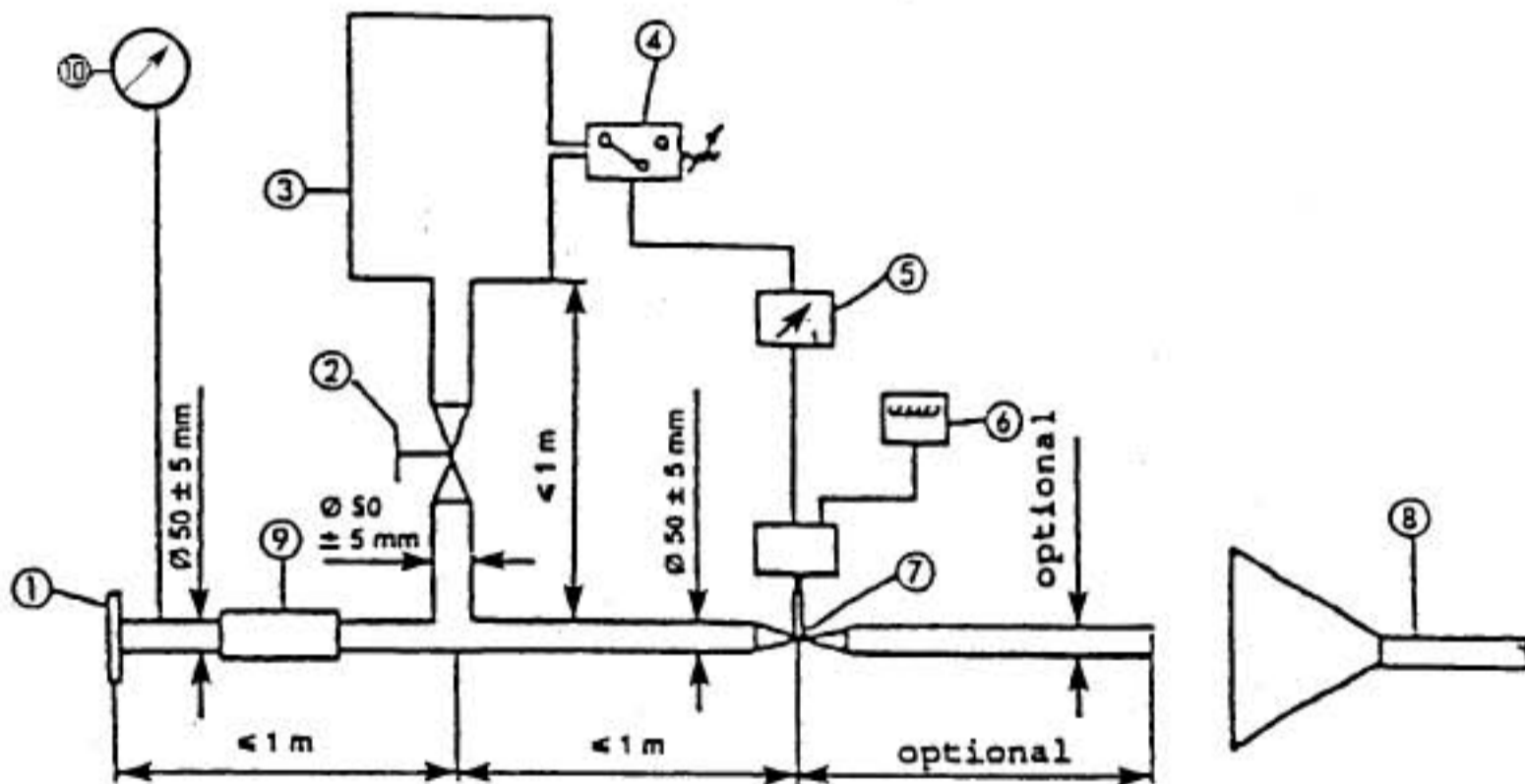


| Phase | Conditions         | Duration of phase               |                              |
|-------|--------------------|---------------------------------|------------------------------|
|       |                    | Engines $\leq 175 \text{ cm}^3$ | Engines $> 175 \text{ cm}^3$ |
|       |                    | (minutes)                       | (minutes)                    |
| 1     | Idling             | 6                               | 6                            |
| 2     | 25% load at 75% S  | 40                              | 50                           |
| 3     | 50% load at 75% S  | 40                              | 50                           |
| 4     | 100% load at 75% S | 30                              | 10                           |
| 5     | 50% load at 100% S | 12                              | 12                           |
| 6     | 25% load at 100% S | 22                              | 22                           |
|       | Total time         | 2.5 hours                       | 2.5 hours                    |

### 1.3.3.5

During this conditioning procedure, at the request of the manufacturer, the engine and the silencer may be cooled in order that the temperature recorded at a point not more than 100 mm from the exhaust gas outlet does not exceed that measured when the motor cycle is running at 110 km/h or 75% S in top gear. The engine and/or motor cycle speeds are determined to within  $\pm 3\%$ .

**Figure 1**  
**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 litres.
4. Pressure switch with an operating range of 0.05 to 2.5 bar.
5. Time delay switch.
6. Impulse counter.
7. Quick response 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 seconds.
8. Exhaust gas evacuation.
9. Flexible pipe.
10. Pressure gauge.