

ANNEX IV

SILENCING SYSTEMS CONTAINING
ACOUSTICALLY ABSORBING FIBROUS MATERIALS

1. GENERAL

Sound absorbing fibrous materials may be used in silencing systems, or components thereof, where either of the following conditions are fulfilled:

- (a) the exhaust gas is not in contact with the fibrous materials; or
- (b) the silencing system, or components thereof, are of the same design family as systems or components for which it has been proven, in the course of EU type-approval process in accordance with the requirements of this Regulation for another vehicle-type, that they are not subject to deterioration.

Where neither the condition in point (a) nor in point (b) of the first subparagraph is fulfilled, the complete silencing system, or components thereof, shall be submitted to a conventional conditioning using one of three installations and procedures described in points 1.1, 1.2 and 1.3.

For the purposes of point (b) of the first subparagraph, a group of silencing system, or components thereof, shall be considered as being of the same design family when all of the following characteristics are the same:

- (a) the presence of net gas flow of the exhaust gases through the absorbing fibrous material when in contact with that material;
- (b) the type of the fibres;
- (c) where applicable, binder material specifications;
- (d) average fibre dimensions;
- (e) minimum bulk material packing density in kg/m³;
- (f) maximum contact surface between the gas flow and the absorbing material.

1.1. Continuous road operation for 10 000 km.

1.1.1. 50 ± 20 % of this operation shall consist of urban driving and the remaining operation shall be long-distance runs at high speed; continuous road operation may be replaced by a corresponding test-track programme.

1.1.2. The two speed regimes shall be alternated at least twice.

1.1.3. The complete test programme shall 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 silencing system, or components thereof, shall be fitted to the vehicle referred to in point 1.3 of Annex I or the engine referred to in point 1.4 of Annex I. In the case of the vehicle referred to in point 1.3 of Annex I, the vehicle shall be mounted on a roller dynamometer. In the case of an engine referred to in point 1.4 of Annex I, the engine shall be coupled to a dynamometer.

- 1.2.2. The test shall 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 and any condensation which may occur.
- 1.2.3. During each six-hour period, the engine shall be run, under the following conditions in turn:
- (a) five minutes at idling speed;
 - (b) one-hour sequence under 1/4 load at 3/4 of rated maximum speed (S);
 - (c) one-hour sequence under 1/2 load at 3/4 of rated maximum speed (S);
 - (d) 10-minute sequence under full load at 3/4 of rated maximum speed (S);
 - (e) 15-minute sequence under 1/2 load at rated maximum speed (S);
 - (f) 30-minute sequence under 1/4 load at rated maximum speed (S).

Total duration of the six sequences: three hours.

Each period shall comprise two sequenced sets of those conditions in consecutive order from (a) to (f).

- 1.2.4. During the test, the silencing system, or components thereof, shall not be cooled by a forced draught simulating normal airflow around the vehicle. Nevertheless, at the request of the manufacturer, the silencing system or components thereof 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 silencing system or components thereof shall be fitted to the vehicle referred to in point 1.3 of Annex I or the engine referred to in point 1.4 of Annex I. In the former case the vehicle shall be mounted on a roller dynamometer.

In the second case, the engine shall be mounted on a dynamometer. The test apparatus, a detailed diagram of which is shown in Figure 1 of the Appendix to this Annex shall be fitted at the outlet of the silencing system. Any other apparatus providing equivalent results shall be acceptable.

- 1.3.2. The test apparatus shall be adjusted in 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 shall 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 kPa. It shall 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 point 1.3.3.
- 1.3.5. Engine speed shall be 75 % of the speed (S) at which the engine develops maximum power.
- 1.3.6. The power indicated by the dynamometer shall be 50 % of the full-throttle power measured at 75 % of engine speed (S).
- 1.3.7. Any drain holes shall be closed off during the test.

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

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