COMMISSION DIRECTIVE

of 13 April 1981

adapting to technical progress Council Directive 70/157/EEC on the approximation of the laws of the Member States relating to the permissible sound level and the exhaust system of motor vehicles

(81/334/EEC)

THE COMMISSION OF THE EUROPEAN COMMUNITIES

Having regard to the Treaty establishing the European Economic Community,

Having regard to Council Directive 70/156/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers [1], as last amended by Directive 80/1267/EEC [2], and in particular Article 13 thereof,

Having regard to Council Directive 70/157/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the permissible sound level and the exhaust system of motor vehicles [3], as last amended by Directive 77/212/EEC [4], and in particular Article 3 thereof,

Whereas, as a result of experience gained in this field, and bearing in mind the present state of the art, it is now possible to amend the requirements relating to the method of measuring the noise of moving and stationary vehicles in order to bring them more into line with real operating conditions;

Whereas the provisions of Article 3 of Directive 70/157/EEC exclude the modification of the limit values from the procedure of adaptation to technical progress; whereas it is appropriate to insert, for information, in this Directive the limit values such as they appear in Directive 77/212/EEC; whereas, however, it is planned to lower those values, in due time, in conformity with the procedure provided for this matter;

Whereas both exhaust systems and certain components thereof are marketed separately as spare parts; whereas, in so far as they can also be checked before being fitted to a vehicle, their free movement could be facilitated by the establishment of an EEC type-approval procedure in respect of these separate systems considered as separate technical units within the meaning of Article 9a inserted into Directive 70/156/EEC by Directive 78/315/EEC [5];

Whereas the provisions of this Directive are in accordance with the opinion of the Committee on the Adaptation to Technical Progress of the Directives aimed at the Removal of Technical Barriers to Trade in the Motor Vehicles Sector,

HAS ADOPTED THIS DIRECTIVE:

Article 1

Directive 70/157/EEC is hereby amended as follows:

1. Article 2 shall be replaced by the following:

'*Article 2*

No Member State may, on grounds relating to the permissible sound level and the exhaust system, refuse to grant EEC or national type-approval in respect of a type of motor vehicle or type of exhaust system or component of such a system regarded as a separate technical unit,

— if the vehicle satisfies the requirements of Annex I as regards the sound level and exhaust system,

— if the exhaust system or any component thereof, considered as a separate technical unit within the meaning of Article 9a of Directive 70/156/EEC satisfies the requirements of Annex II.'

2. Article 2a shall be replaced by the following:

'*Article 2a*

1. No Member State may, on grounds relating to the permissible sound level and the exhaust system,

(1) OJ No L 42, 23. 2. 1970, p. 1.
(1) OJ No L 375, 31. 12. 1980, p. 34.
(3) OJ No L 42, 23. 2. 1970, p. 16.
(4) OJ No L 66, 12. 3. 1977, p. 33.
(5) OJ No L 81, 28. 3. 1978, p. 1.

refuse or prohibit the sale, registration, entry into service or use of any vehicle in which the sound level and the exhaust system satisfy the requirements of Annex I.

2. No Member State may, on grounds relating to the permissible sound level and the exhaust system, prohibit the placing on the market of an exhaust system or any component thereof considered as a separate technical unit within the meaning of Article 9a of Directive 70/156/EEC if, within the meaning of Article 2, it is of a type in respect of which a type-approval has been granted.'

3. In Article 3, 'items I.1 and I.4.1.4' shall be replaced by 'items 5.2.2.1 and 5.2.2.5 of Annex I'.

4. The Annex shall be replaced by Annexes I, II, III and IV to this Directive.

Article 2

1. With effect from 1 January 1982, no Member State may, on grounds relating to the permissible sound level and the exhaust system:

— refuse to grant EEC type-approval, to issue the document referred to in the last indent of Article 10 (1) of Directive 70/156/EEC or to grant national type-approval, in respect of a type of motor vehicle, or

— prohibit the entry into service of vehicles,

if the sound level and the exhaust system of this type of vehicle, or the vehicles concerned, comply with the provisions of Directive 70/157/EEC, as amended by the present Directive.

2. With effect from 1 October 1984, a Member State:

— shall no longer issue the document referred to in the last indent of Article 10 (1) of Directive 70/156/EEC in respect of a type of motor vehicle in which the sound level and exhaust system do not comply with the provisions of Directive 70/157/EEC, as amended by the present Directive,

— may refuse to grant national type-approval in respect of a type of motor vehicle in which the sound level and exhaust system do not comply with the provisions of Directive 70/157/EEC, as amended by the present Directive.

3. With effect from 1 October 1985, Member States may prohibit the entry into service of vehicles in which the sound level and exhaust system do not comply with the provisions of Directive 70/157/EEC, as amended by the present Directive.

Article 3

By 1 January 1982, Member States shall apply the provisions necessary to comply with this Directive. They shall forthwith inform the Commission thereof.

Article 4

This Directive is addressed to the Member States.

Done at Brussels, 13 April 1981.

For the Commission

Karl-Heinz NARJES

Member of the Commission

ANNEX I

EEC TYPE-APPROVAL IN RESPECT OF THE SOUND LEVEL OF A TYPE OF MOTOR VEHICLES

1. DEFINITIONS

1.1. **Type of vehicle for the purposes of EEC type-approval as regards its sound level**

For the purposes of this Directive, 'type of vehicle' means vehicles which do not differ essentially as regards the following parts:

1.1.1. the shape or materials of the bodywork (particularly the engine compartment and its soundproofing);

1.1.2. the length and width of the vehicle;

1.1.3. the type of engine (two- or four-stroke, reciprocating or rotary piston, number and capacity of cylinders, number and type of carburettors or injection systems, arrangement of valves, rated maximum power and corresponding engine speed (S));

1.1.4. the transmission system, particularly the number of gears and their ratios;

1.1.5. the number, type and arrangement of the exhaust systems;

1.1.6. the number, type and arrangement of the intake systems.

1.2. **Exhaust and intake systems**

1.2.1. 'Exhaust system' means a complete set of parts necessary to reduce the noise produced by the vehicle's engine exhaust.

1.2.2. 'Intake system' means a complete set of parts necessary to reduce the noise produced by the vehicle's engine intake.

1.2.3. For the purposes of this Directive, these systems do not include the manifolds.

1.3. **Different types of exhaust or intake system**

'Different types of exhaust or intake system' means systems characterized by fundamental differences, such as the following:

1.3.1. systems bearing different trade marks or trade names;

1.3.2. systems in which the characteristics of the materials of a component differ, or in which the components are of different shape or size; a change in the plating procedure (galvanization, aluminium coating, etc.) is not deemed to produce a difference of type;

1.3.3. systems in which the operating principles of at least one component differ;

1.3.4. systems in which the components are combined differently.

1.4. **Component of an exhaust or intake system**

'Component of an exhaust or intake system' means one of the separate components which together form the exhaust system (e.g. exhaust pipes, the silencer proper) or the intake system (e.g. air filter).

2. APPLICATION FOR EEC TYPE-APPROVAL

2.1. The application for EEC type-approval in respect of the sound level of a type of motor vehicle must be submitted by the manufacturer of the vehicle or his authorized representative.

2.2. It must be accompanied by the undermentioned documents in triplicate and the following information:

2.2.1. a description of the type of vehicle with reference to the points mentioned in item 1.1 above. The numbers and/or symbols identifying the engine type and vehicle type must be indicated;

2.2.2. a list, with appropriate identification, of the component parts of the exhaust and intake systems;

2.2.3. a drawing of the entire exhaust system with an indication of its position on the vehicle;

2.2.4. a detailed drawing of each component so that it can be easily located and identified, and an indication of the materials used.

2.3. A vehicle representative of the type in respect of which type-approval is sought must be submitted to the technical service responsible for the tests by the vehicle manufacturer or his authorized representative.

2.4. At the request of the technical service, a specimen of the exhaust system and an engine of at least the same cylinder capacity and rated maximum power as that fitted to the vehicle in respect of which type-approval is sought must also be submitted.

3. MARKINGS

3.1. The exhaust and intake system components, excluding fixing hardware and pipes, must bear:

3.1.1. the trade mark or name of the manufacturer of the systems and their components;

3.1.2. the manufacturer's trade description.

3.2. These markings must be clearly legible and indelible.

4. EEC TYPE-APPROVAL

4.1. If an application within the meaning of item 2.1 is approved, the competent authority will draw up a certificate, corresponding to the type which appears in Annex III, to be attached to the EEC vehicle type-approval certificate.

5. SPECIFICATIONS

5.1. **General specifications**

5.1.1. The vehicle, its engine and exhaust and intake systems must be designed, constructed and mounted such that, under normal conditions of use and notwithstanding the vibrations to which they may be subject, the vehicle satisfies the requirements of this Directive.

5.1.2. The systems must be designed, constructed and mounted so that reasonable resistance to the corrosion phenomena to which they are exposed is obtained having regard to the conditions of use of the vehicle.

5.2. **Specifications relating to sound levels**

5.2.1. *Method of measurement*

5.2.1.1. The sound emitted by the type of vehicle submitted for EEC type-approval must be measured in accordance with each of the two methods described in item 5.2.2.4 in the case of moving vehicles and item 5.2.3.4 in the case of stationary vehicles, respectively (1).

5.2.1.2. The two values measured as specified in item 5.2.1.1, above, must be recorded in the test report and in a certificate corresponding to the model shown in Annex III.

5.2.2. *Sound level of moving vehicles*

5.2.2.1. Limiting values

The sound level measured in accordance with items 5.2.2.2 to 5.2.2.5, inclusive, of this Annex shall not exceed the following limits:

	Vehicle categories	Values expressed in dB(A) (decibels (A))
5.2.2.1.1.	Vehicles intended for the carriage of passengers, and comprising not more than nine seats including the driver's seat	80
5.2.2.1.2.	Vehicles intended for the carriage of passengers, comprising more than nine seats including the driver's seat and having a maximum permissible mass not exceeding 3·5 tonnes	81
5.2.2.1.3.	Vehicles intended for the carriage of goods, and having a maximum permissible mass not exceeding 3·5 tonnes	81
5.2.2.1.4.	Vehicles intended for the carriage of passengers, comprising more than nine seats including the driver's seat and having a maximum permissible mass exceeding 3·5 tonnes	82
5.2.2.1.5.	Vehicles intended for the carriage of goods and having a maximum permissible mass exceeding 3·5 tonnes	86
5.2.2.1.6.	Vehicles intended for the carriage of passengers, comprising more than nine seats including the driver's seat and having an engine power equal to or exceeding 147 kW	85
5.2.2.1.7.	Vehicles intended for the carriage of goods, having an engine power equal to or exceeding 147 kW and a maximum permissible mass exceeding 12 tonnes	88

5.2.2.2. Measuring instruments

5.2.2.2.1. Acoustic measurements

The apparatus used for measuring the noise level must be a precision sound-level meter of the type described in Publication 179 'Precision sound level meters', second edition, of the International Electrotechnical Commission (IEC). Measurements must be carried out using the 'fast' response of the sound-level meter and the 'A' weighting curve which are also described in that publication.

At the beginning and end of each set of measurements, the sound-level meter must be calibrated according to the manufacturer's instructions by means of an appropriate sound source (e.g. a pistonphone). The test must be considered invalid if the sound-level meter errors registered during this calibration exceed 1 dB.

(1) A stationary vehicle test is conducted in order to establish a reference value for the authorities which employ this method for the inspection of vehicles in service.

5.2.2.2.2. Speed measurements

The engine speed and vehicle speed on the test section shall be determined with an accuracy of 3 % or better.

5.2.2.3. Conditions of measurement

5.2.2.3.1. Test site

The test site must consist of a central acceleration section surrounded by a substantially flat test area. The acceleration section must be level; the track surface must be dry and such that rolling noise remains low.

The test track must be such that the conditions of a free sound field between the sound source and the microphone are attained to within 1 dB. This condition shall be deemed to be met if there are no large sound-reflecting objects such as fences, rocks, bridges or buildings within 50 m of the centre of the acceleration section. The surface of the site must be made of hard materials such as concrete, asphalt or any other acoustically equivalent material within a minimum radius of 10 m around the centre of the acceleration section and be free of powdery snow, tall grass, loose soil or cinders.

There must be no obstacle which could affect the sound field within the vicinity of the microphone and no persons shall stand between the microphone and the sound source. The observer carrying out the measurements must so position himself as not to affect the readings of the measuring instrument.

5.2.2.3.2. Meteorological conditions

Measurements must not be made in poor atmospheric conditions. It must be ensured that the results are not affected by gusts of wind.

5.2.2.3.3. Ambient noise

For measurements, the A-weighted sound level of sound sources other than those of the vehicle to be tested and of wind effects must be at least 10 dB(A) below the sound level produced by the vehicle. A suitable windscreen may be fitted to the microphone provided that account is taken of its effect on the sensitivity and directional characteristics of the microphone.

5.2.2.3.4. Condition of the vehicle

For these measurements, the vehicle must be in running order as defined in item 2.6 of Annex I to Directive 70/156/EEC and, except in the case of vehicles which cannot be uncoupled, without trailer or semi-trailer.

The vehicle's tyres must be of the type normally fitted to such vehicles by the manufacturer and must be inflated to the appropriate pressure(s) for the unladen vehicle.

Before the measurements are made, the engine must be brought to its normal operating condition as regards temperatures, settings, fuel, spark plugs, carburettor(s), etc. (as appropriate). If the vehicle is fitted with fan(s) having an automatic actuating mechanism, this system must not be interfered with during the measurements.

Only the normal highway drive must be engaged in vehicles with more than two drive wheels.

5.2.2.4. Method of measurement

5.2.2.4.1. Nature and number of measurements

The maximum sound level expressed in A-weighted decibels (dB(A)) shall be measured as the vehicle is driven between lines AA' and BB' (Figure 1). The measurement shall be invalid if an abnormal discrepancy between the peak value and the general sound level is recorded.

At least two measurements must be taken on each side of the vehicle.

5.2.2.4.2. Positioning of the microphone

The microphone must be located at a distance of 7·5 ± 0·2 m from the reference line CC' (Figure 1) of the track and 1·2 ± 0·1 m above the ground. Its axis of maximum sensitivity must be horizontal and perpendicular to the path of the vehicle (line CC').

5.2.2.4.3. Conditions of operation

5.2.2.4.3.1. General conditions

For all measurements, the vehicle must be driven in a straight line over the acceleration section in such a way that the longitudinal median plane of the vehicle is as close as possible to the line CC'.

The vehicle must approach the line AA' at a steady initial road speed as specified in items 5.2.2.4.3.2 and 5.2.2.4.3.3. When the front end of the vehicle has reached the line AA', the throttle must be fully opened as quickly as practically possible. This throttle position must be maintained until the rear end of the vehicle reaches the line BB' ; the throttle must then be returned to the idling position as quickly as possible.

The trailers of articulated vehicles which cannot be uncoupled must not be taken into account as regards the crossing of line BB'.

5.2.2.4.3.2. Approach speed

The vehicle must approach the line AA' at a steady speed corresponding to the lower of the two following speeds:

— the speed corresponding to an engine speed equal to three-quarters of the speed (S) at which the engine develops rated maximum power;

— 50 km/h.

If the vehicle is fitted with an automatic gearbox which has no manual selector, it must be tested at different approach speeds: 30, 40 and 50 km/h or at three-quarters of maximum road speed if this value is lower. The test result will be that obtained from the speed producing the maximum sound level.

5.2.2.4.3.3. Choice of gear ratios (in vehicles fitted with gearboxes).

5.2.2.4.3.3.1. Manually-operated, non-automatic gearbox.

5.2.2.4.3.3.1.1. Vehicles in categories M_1 and N_1 [1] fitted with a gearbox having not more than four forward gear ratios must be tested in second gear.

Vehicles in these categories fitted with a gearbox having more than four forward gear ratios are to be tested in second and third gear in turn. Only overall gear ratios intended for normal road use must be considered. The arithmetic mean of the sound levels recorded for each of these two conditions must be calculated.

5.2.2.4.3.3.1.2. Vehicles other than those in categories M_1 and N_1 [1] in which the total number of forward gear ratios is X (including the ratios obtained by means of an auxiliary gearbox or a multiple-ratio drive axle) must be tested using, in turn, ratios equal to or higher than $\frac{X}{2}$ [2]. The test result will be that obtained from the ratio producing the maximum sound level.

Notwithstanding the provisions of items 1.1.2 and 1.1.4, vehicles having the same type of engine and exhaust and intake systems, but different lengths or widths and different overall gear ratios, may be regarded as vehicles of the same type. In this case, it will be sufficient to test a single vehicle representative of the type in question, in principle, by selecting as the test vehicle that with the lowest weight in running order.

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[1] In accordance with the definition given in item 0.4 of Annex I to Directive 70/156/EEC (OJ No L 42, 23. 2. 1970).

[2] If $\frac{X}{2}$ does not correspond to a whole number, the nearest higher ratio must be used.

If the maximum sound level is obtained between the ratios $\frac{X}{2}$ and X, the vehicle selected shall be deemed representative of its type.

If this is not the case, the tests must be extended to cover the whole range of overall gear ratios to be taken into consideration for vehicles of this type.

5.2.2.4.3.3.2. Automatic gearbox fitted with manual selector.

If the vehicle is fitted with a manual selector with X forward positions, the test must be conducted with the selector in position X; the forced change-down facility (e.g. 'kick-down') must be put out of action. If automatic change-down occurs after the line AA', has been crossed, the test must be restarted using, as necessary, the higher of the two selector positions X–1 and X–2, which enables the test to take place without automatic change-down (the forced change-down facility continuing to be out of action).

If the vehicle is fitted with a manually-operated auxiliary gearbox or a multiple ratio drive axle, the position corresponding to normal town driving must be used. The special selector positions for slow manoeuvres, or braking, must not be used.

5.2.2.5. Interpretation of results

5.2.2.5.1. To take account of inaccuracies in the measuring instruments, the result obtained from each measurement shall be determined by deducting 1 dB(A) from the meter reading.

5.2.2.5.2. The measurements shall be considered valid if the difference between two consecutive measurements on the same side of the vehicle does not exceed 2 dB(A).

5.2.2.5.3. The highest sound level measured shall constitute the test result. Should the result exceed the maximum permissible sound level for the category of vehicle tested by 1 dB(A), two further measurements shall be made. Three of the four measurements thus obtained must fall within the prescribed limits.

5.2.3. *Sound level of the stationary vehicle*

5.2.3.1. Sound level in the vicinity of vehicles

In order to facilitate subsequent checks on vehicles in use, the sound level must be measured close to the exhaust system outlet in accordance with the following requirements and the measurement results entered in the test report drawn up for the purpose of issuing the certificate referred to in Annex III.

5.2.3.2. Measuring instruments

5.2.3.2.1. Acoustic measurements

A precision sound-level meter as defined in item 5.2.2.2.1 must be used for the measurements.

5.2.3.2.2. Measurements of engine speed

The engine speed shall be determined by means of a tachometer having an accuracy of 3 % or better. The tachometer must be a separate one from the one of the vehicle.

5.2.3.3. Conditions of measurement

5.2.3.3.1. Test site (Figure 2)

Any area not subject to significant acoustic disturbance may be used as a test site. Flat surfaces which are covered in concrete, asphalt or any other hard surfacing and possess a high degree of reflectivity are particularly suitable; surfaces consisting of earth which has been tamped down must not be used.

The test site must be in the form of a rectangle, the sides of which are at least 3 m from the sides of the vehicle. This rectangle must not contain any significant obstacles, e.g. an individual other than the observer and the driver. The vehicle must be positioned within the abovementioned rectangle so that the microphone is at least 1 m from any kerbstone.

5.2.3.3.2. Meterological conditions

Measurements must not be made in poor atmospheric conditions. It must be ensured that the results are not affected by gusts of wind.

5.2.3.3.3. Ambient noise

Readings on the measuring instruments produced by ambient noise and wind must be at least 10 dB(A) below the sound level to be measured. A suitable windscreen may be fitted to the microphone provided that account is taken of its effect on the sensitivity of the microphone.

5.2.3.3.4. Condition of the vehicle

The vehicle engine must be brought to normal running temperature before measurements commence. If the vehicle is fitted with fan(s) having an automatic actuating mechanism, this system shall not be interfered with during the sound-level measurements.

During measurements, the gear lever must be in the neutral position.

5.2.3.4. Method of measurement

5.2.3.4.1. Nature and number of measurements

The maximum sound level expressed in A-weighted decibels (dB(A)) must be measured during the operating period referred to in item 5.2.3.4.3.

At least three measurements must be taken at each measuring point.

5.2.3.4.2. Position of the microphone (Figure 2)

The microphone must be located level with the exhaust outlet or 0·2 m above the test-track surface, whichever is the higher. The microphone diaphragm must face the exhaust outlet at a distance of 0·5 m from the latter. The axis of maximum sensitivity of the microphone must be parallel to the track surface at an angle of 45° ± 10° to the vertical plane defined by the direction in which the exhaust gases are emitted.

The microphone must be positioned to the side of this vertical plane which gives the greatest possible distance between the microphone and the vehicle contour.

If the exhaust system has several outlets, the centres of which are not more than 0·3 m apart, and which are connected to the same silencer, the microphone must face the outlet closest to the vehicle contour or the outlet which is the highest above the track surface. In all other cases separate measurements must be taken at each of them, the highest figure recorded being taken as the test value.

In the case of vehicles fitted with a vertical exhaust outlet (e.g. commercial vehicles), the microphone must be positioned at the level of the exhaust outlet, facing upwards with its axis vertical. It must be positioned at a distance of 0·5 m from the side of the vehicle closest to the exhaust outlet.

Where the design of the vehicle is such that the microphone cannot be located as shown in Figure 2 because of the presence of obstacles which form part of the vehicle (e.g. spare wheel, fuel tank, battery compartment), a drawing clearly indicating the position for the microphone must be made when the measurement is conducted. As far as possible, the microphone must be more than 0·5 m from the nearest obstacle, and its axis of maximum sensitivity must face the exhaust outlet from the position least concealed by the abovementioned obstacles.

5.2.3.4.3. Conditions of engine operation

Engine speed must be stabilized at three-quarters of the speed (S) at which the engine develops rated maximum power.

When constant engine speed is reached, the throttle must be rapidly returned to the idling position. The sound level must be measured over an operating period comprising brief maintenance of constant engine speed and the entire deceleration period, the maximum sound-level meter reading being taken as the test result.

5.2.3.5. Results (test report)

5.2.3.5.1. The test report drawn up for the purpose of issuing the certificate referred to in Annex III shall indicate all relevant data, particularly those used in measuring the sound of the stationary vehicle.

5.2.3.5.2. Readings, rounded off to the nearest decibel, shall be taken from the measuring instrument.

Only those values obtained from three consecutive measurements which do not differ by more than 2 dB(A) respectively will be taken into consideration.

5.2.3.5.3. The highest of these three values shall constitute the test result.

5.3. **Exhaust systems containing fibrous materials**

5.3.1. 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 item 5.2.2.1 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 items 5.2.2 and 5.2.3 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 items 5.3.1.1, 5.3.1.2 and 5.3.1.3, below, or by removing the fibrous materials from the silencer.

5.3.1.1. Continuous road operation for 10 000 km

5.3.1.1.1. About half this operation shall consist 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.

5.3.1.1.2. The two speed regimes must be alternated on several occasions.

5.3.1.1.3. 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.

5.3.1.2. Conditioning on a test bench

5.3.1.2.1. Using standard parts and observing the vehicle manufacturer's instructions, the silencer must be fitted to the engine, which is coupled to a dynamometer.

5.3.1.2.2. 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.

5.3.1.2.3. 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 abovementioned sequences.

5.3.1.2.4. 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.

5.3.1.3. Conditioning by pulsation

5.3.1.3.1. The exhaust system or components thereof must be fitted to the vehicle referred to in item 2.3 or the engine referred to in item 2.4. 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, must be fitted at the outlet of the exhaust system. Any other apparatus providing equivalent results is acceptable.

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

5.3.1.3.3. 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.

5.3.1.3.4. The time-delay switch shall be set for the duration of gas exhaust resulting from the provisions laid down in item 5.3.1.3.3 above.

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

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

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

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

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

5.3.2. If the provisions of Article 8 (3) of Directive 70/156/EEC concerning EEC type-approval are to be applied, the test method set out in item 5.3.1.2 above must be employed.

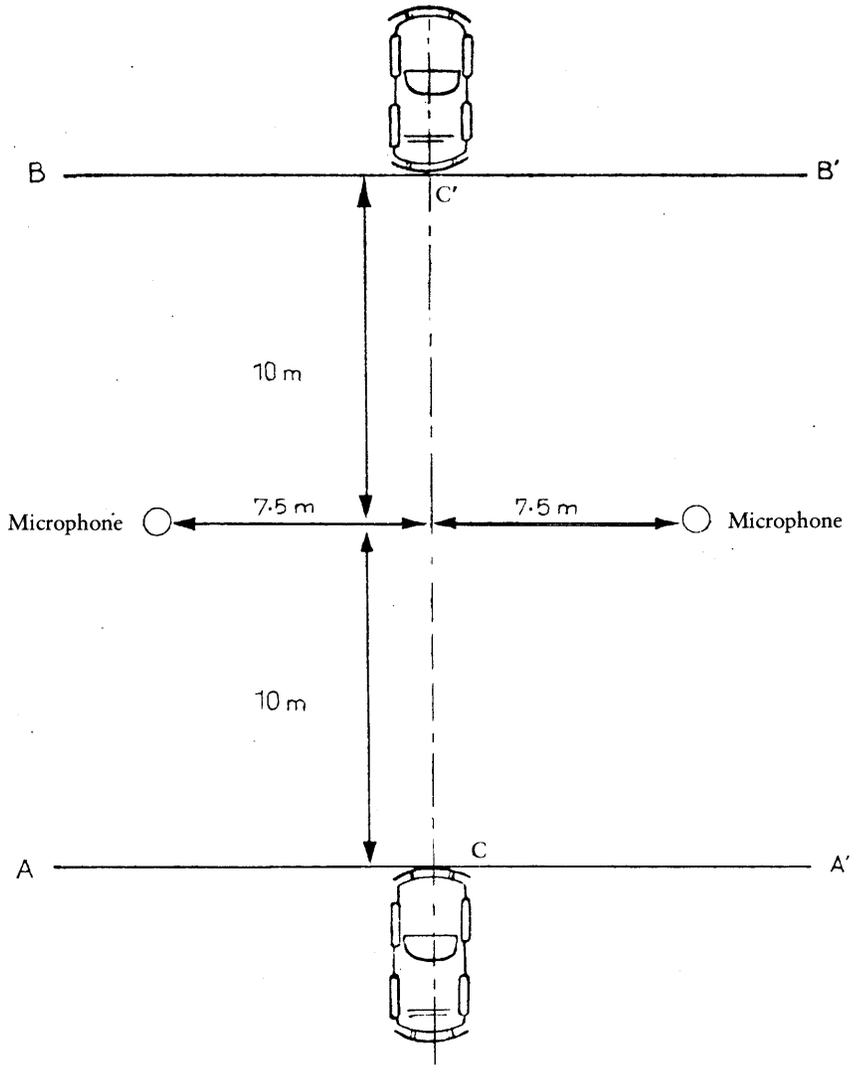


Figure 1

Microphone positions for the measurement of a moving vehicle

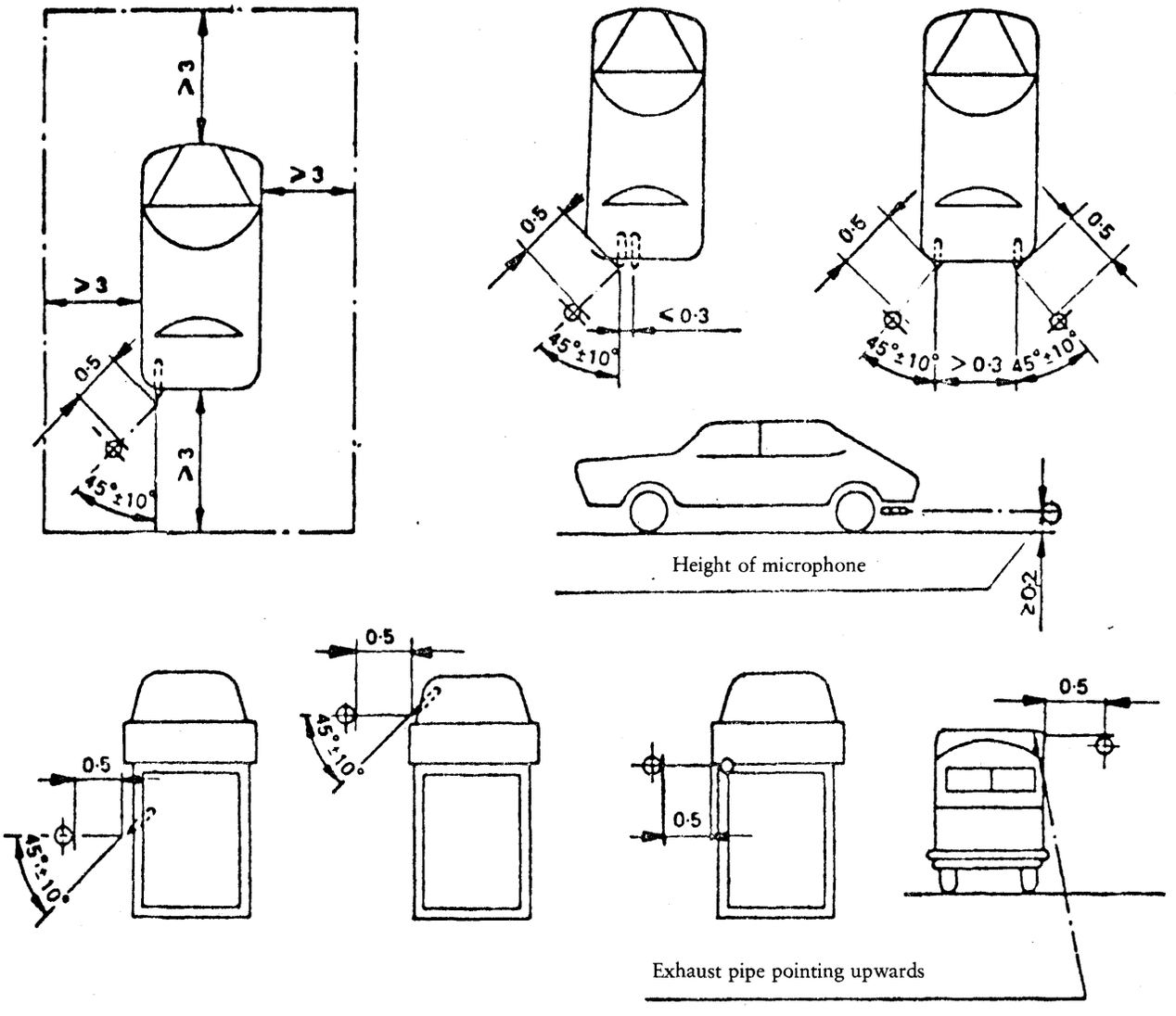


Figure 2

Test site and microphone positions for the measurement of a stationary vehicle

All distances are given in metres

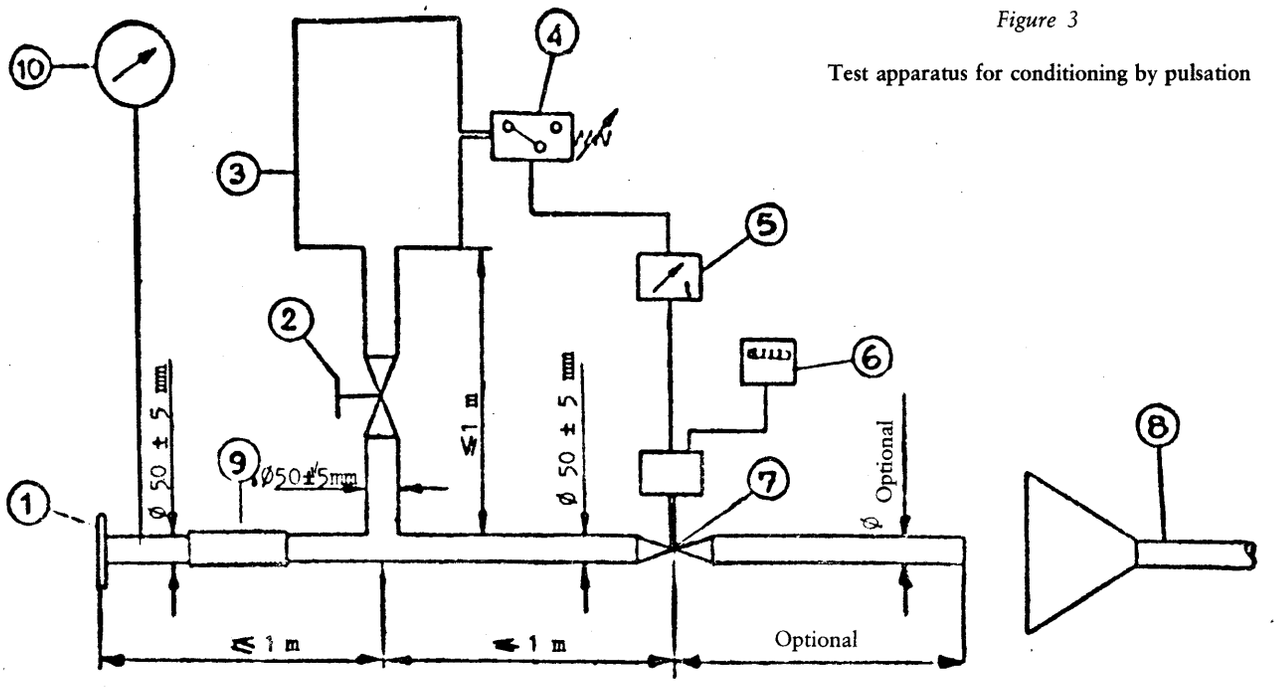


Figure 3

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 having a capacity of from 35 to 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 second
8. Exhaust gas evacuation
9. Flexible pipe
10. Pressure gauge

ANNEX II

EEC TYPE-APPROVAL OF EXHAUST SYSTEMS AS SEPARATE TECHNICAL UNITS (REPLACEMENT EXHAUST SYSTEMS)

0. SCOPE

This Annex applies to the type-approval, as separate technical units within the meaning of Article 9a of Directive 70/156/EEC, of exhaust systems or components thereof to be fitted to one or more given types of motor vehicle in categories M_1 and N_1 as replacement parts.

1. DEFINITIONS

1.1. 'Replacement exhaust system or component thereof' means any part of the exhaust system defined in item 1.2.1 of Annex I intended to replace on a vehicle a part of the type granted EEC type-approval with the vehicle in accordance with Annex I.

2. APPLICATION FOR EEC TYPE-APPROVAL

2.1. Application for EEC type-approval in respect of a replacement exhaust system or component thereof as a separate technical unit must be submitted by the vehicle manufacturer of the separate technical unit in question or by their authorized representatives.

2.2. Application for EEC type-approval in respect of each type of replacement exhaust system or component thereof must be accompanied by the undermentioned documents in triplicate and the following information:

2.2.1. — a description of the type(s) of vehicle to which the system or components thereof are to be fitted with reference to the characteristics mentioned in item 1.1 of Annex I. The numbers and/or symbols designating the engine and vehicle type must be indicated;

2.2.2. — a description of the replacement exhaust system indicating the relative position of each system component, together with mounting instructions;

2.2.3. — detailed drawings of each component, so that they can be easily located and identified, and reference to the materials used.

These drawings must indicate the place provided for the compulsory affixing of the EEC type-approval.

2.3. At the request of the technical service concerned, the applicant must submit:

2.3.1. — two examples of the system in respect of which application for EEC type-approval has been made;

2.3.2. — an exhaust system of the type originally fitted to the vehicle when EEC type-approval was granted;

2.3.3. — a vehicle representative of the type to which the system is to be fitted:

— which, as far as its noise level when moving is concerned, must be in such a condition that it respects the limits in item 5.2.2.1 of Annex I and does not exceed by more than 3 dB(A) the values obtained during the type-approval tests and

— which, as far as its noise level when stationary is concerned, respects the value obtained during the type-approval;

2.3.4. — a separate engine corresponding to the type of vehicle described above.

3. MARKINGS

3.1. The replacement exhaust system or its components, excluding fixing hardware and pipes must bear:

3.1.1. — the trade mark or trade name of the manufacturer of the replacement system and its components;

3.1.2. — the manufacturer's commercial description;

3.1.3. — the EEC type-approval number preceded by the distinctive letter(s) of the country granting EEC type-approval (1).

3.2. These marks must be clearly legible and indelible.

4. EEC TYPE-APPROVAL

4.1. If an application within the meaning of item 2.1 is approved, the competent authority will draw up a certificate corresponding to the model shown in Annex IV. The type-approval number must be preceded by the distinctive letter(s) of the country granting EEC type-approval.

5. SPECIFICATIONS

5.1. **General specifications**

5.1.1. The replacement exhaust system or component thereof must be designed, constructed and capable of being mounted so as to ensure that the vehicle complies with the provisions of this Directive under normal conditions of use, notwithstanding any vibrations to which it may be subject.

5.1.2. The exhaust system or components thereof must be designed, constructed and capable of being mounted so that reasonable resistance to the corrosion phenomena to which it/they is/are exposed is obtained having regard to the conditions of use of the vehicle.

5.2. **Specifications relating to sound levels**

5.2.1. The acoustic efficiency of the replacement exhaust system or component thereof must be checked using the methods described in items 5.2.2.4 and 5.2.3.4 of Annex I.

When the replacement exhaust system or component thereof is mounted on the vehicle referred to in item 2.3.3 of this Annex, the sound levels obtained using the two methods (stationary and moving vehicle) must satisfy one of the following conditions:

5.2.1.1. they must not exceed the values obtained when this type of vehicle was granted EEC type-approval;

5.2.1.2. they must not exceed the sound level values measured on the vehicle, referred to in item 2.3.3, when this is fitted with an exhaust system of the same type as that fitted to the vehicle when EEC type-approval was granted.

5.3. **Measurement of vehicle performance**

5.3.1. The replacement exhaust system or components thereof must be such as to ensure that vehicle performance is comparable with that achieved with the original equipment exhaust system or component thereof.

5.3.2. The replacement exhaust system or, depending on the manufacturer's choice, the components of this system must be compared with the original equipment exhaust system or components thereof, which are also in new condition, fitted in turn to the vehicle referred to in item 2.3.3.

(1) B = Belgium, D = Federal Republic of Germany, DK = Denmark, F = France, GR = Greece, I = Italy, IRL = Ireland, L = Luxembourg, NL = Netherlands, UK = United Kingdom.

5.3.3. The check must take the form of a measurement of pressure loss under the conditions specified in item 5.3.4.1 or 5.3.4.2. The value measured with the replacement exhaust system must not exceed the value measured with the original equipment system by more than 25 % under the conditions mentioned below.

5.3.4. *Test Method*

5.3.4.1. Engine test method

The measurement must be conducted on the engine referred to in item 2.3.4 coupled to a dynamometer.

With the throttle completely open, the bench shall be so adjusted as to obtain the engine speed (S) corresponding to the rated maximum power of the engine.

For the measurement of back pressure, the pressure tap must be placed at the distance from the exhaust manifold specified in Figures 1, 2 and 3.

5.3.4.2. Vehicle test method

The measurements must be carried out on the vehicle referred to in item 2.3.3.

The test must be conducted:

— either on a road, or

— on a roller dynamometer.

With the throttle completely open, the engine must be loaded so as to obtain the engine speed (S) corresponding to the rated maximum power.

For the measurement of back pressure, the pressure tap must be placed at the distance from the exhaust manifold specified in Figures 1, 2 and 3.

5.4. **Additional provisions in respect of exhaust systems or components thereof filled with fibrous materials**

Fibrous materials must not be used in the manufacture of replacement exhaust systems or components thereof unless appropriate measures are taken during the design and production stages to ensure that a level of efficiency is attained corresponding to the limits set out in item 5.2.2.1 of Annex I.

Such a silencing system is deemed to be effective in traffic if the exhaust gases are not in contact with the fibrous materials or if, after the removal of the fibrous materials, the sound levels comply with the requirements set out in item 5.2.1 above, when the exhaust system is tested on a vehicle in accordance with the methods described in items 5.2.2 and 5.2.3 of Annex I.

If this condition is not observed, the entire exhaust system must be subjected to conditioning. This must be done using one of the three methods described in items 5.3.1.1, 5.3.1.2 and 5.3.1.3 of Annex I.

After conditioning, the sound level must be checked as specified in item 5.2.1 above.

When the procedure described in item 5.2.1.2 is employed, the applicant for EEC type-approval may ask for the conditioning of the original equipment exhaust system or submit one which has been emptied.

6. CONFORMITY OF PRODUCTION

6.1. Any replacement exhaust system or component thereof bearing an EEC type-approval number pursuant to this Directive must conform to the approved type of exhaust system and comply with the requirements of item 5 above.

6.2. In order to check conformity as required by item 6.1 above, an exhaust system or component thereof bearing the EEC type-approval number must be taken from the series. Production is deemed to conform with the requirements of this Directive if the sound levels measured in accordance with item 5.2 do not exceed the level measured during the EEC type-approval tests of this type of exhaust system or component thereof by more than 1 dB(A).

Back pressure — measuring points

Figure 1

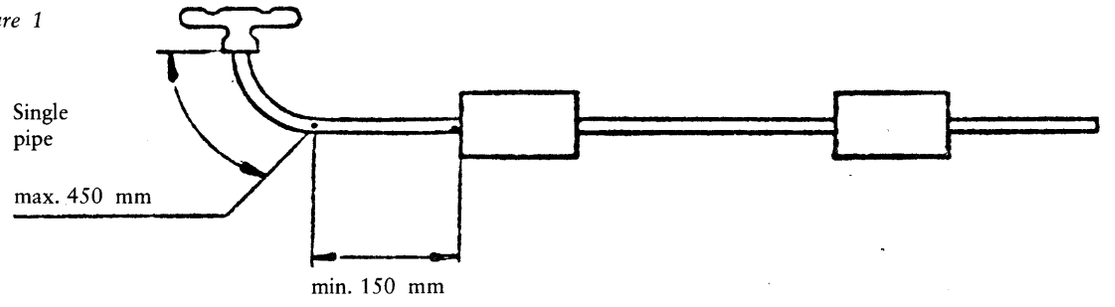


Figure 2 (1)

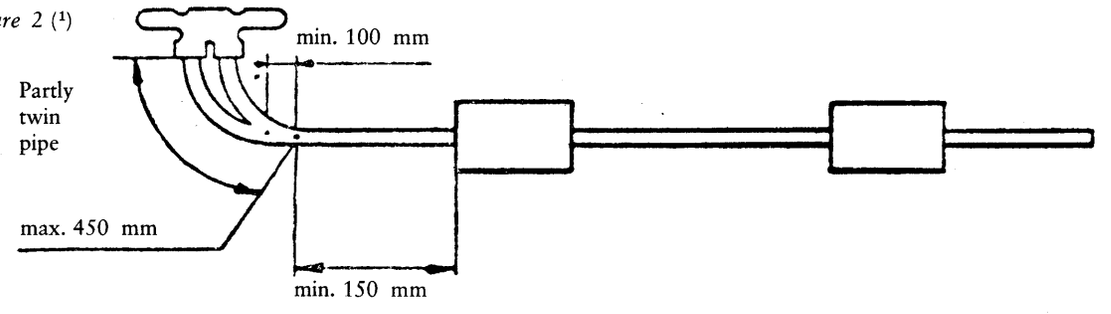
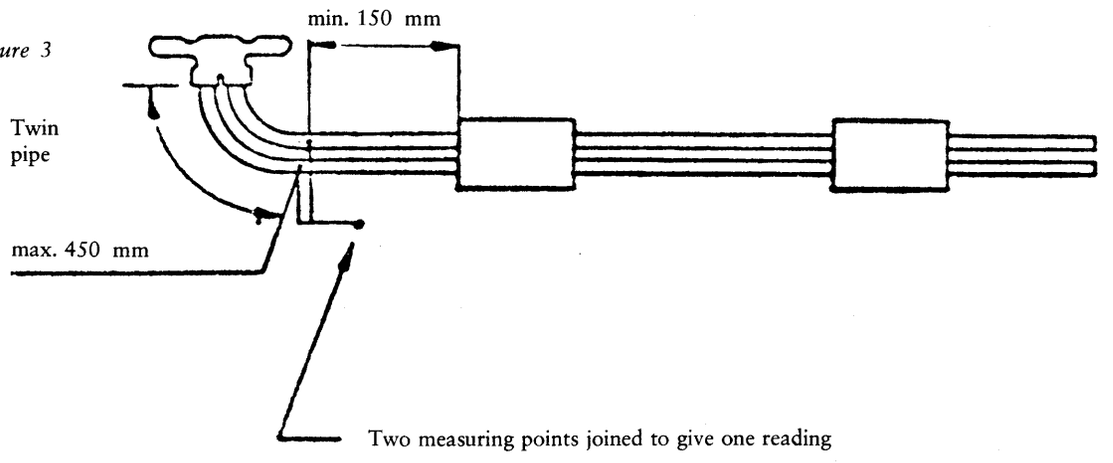


Figure 3



(1) If this is not possible, use Figure 3.

ANNEX III

MODEL
Maximum size: A4 (210 × 297 mm)

Name of administration

ANNEX TO THE EEC VEHICLE TYPE-APPROVAL CERTIFICATE RELATING TO SOUND LEVEL

(Articles 4 (2) and 10 of Council Directive 70/156/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers)

In the light of the amendments made pursuant to Directive 81/334/EEC

EEC type-approval No .....

1. Trademark or trade name of the vehicle: .....

2. Vehicle type: .....

2.1. If necessary, list of vehicles covered by item 5.2.2.4.3.3.1.2 of Annex I .....

3. Manufacturer's name and address: .....

.....

4. If applicable, name and address of the manufacturer's authorized representative: .....

.....

5. Engine:

5.1. Manufacturer: .....

5.2. Type: .....

5.3. Model: .....

5.4. Rated maximum power (1)..... kW at ..... rev/min.

6. Transmission: non-automatic gearbox/automatic gearbox (2)

6.1. Number of gears: .....

7. Equipment: .....

7.1. Exhaust silencer:

7.1.1. Manufacturer or authorized representative (if any):

7.1.2. Model: .....

7.1.3. Type: ..... in accordance with drawing No: .....

7.2. Intake silencer: .....

7.2.1. Manufacturer or authorized representative (if any): .....

7.2.2. Model: .....

7.2.3. Type: ..... in accordance with drawing No: .....

7.3. Tyre size: .....

(1) Established in accordance with Directive 80/1269/EEC (OJ No L 375, 31. 12. 1980, p. 46).
(2) Delete where inapplicable.

8. Measurements:

8.1. Sound level of moving vehicle:

	Measurement results		Position of gear lever
	Left-hand side dB(A) (3)	Right-hand side dB(A) (3)	
1st measurement			
2nd measurement			
3rd measurement			
4th measurement			
Test result:		dB(A)/E (4)	

8.2. Sound level of stationary vehicle:

	dB(A)	Engine speed
1st measurement		
2nd measurement		
3rd measurement		
Test result:		dB(A)/E (4)

9. Vehicle submitted for type-approval on: .....

10. Technical service responsible for type-approval tests: .....

.....

11. Date of test report issued by that service: .....

12. Number of test report issued by that service: .....

13. Type-approval in respect of sound level is hereby granted/refused (1), (2)

14. Place: .....

15. Date: .....

16. Signature: .....

17. The following documents bearing the abovementioned type-approval number are attached to this Annex (to be completed if necessary): .....

18. Remarks: .....

.....

(1) Decision reached in accordance with Directive 81/334/EEC (OJ No L 131, 18 May 1981).
(2) Delete where inapplicable.
(3) The measurement values are given with the 1 dB(A) deduction in accordance with provisions of item 5.2.2.5.1 of Annex I.
(4) 'E' indicates that the measurements in question were conducted in accordance with Directive 81/334/EEC.

ANNEX IV

MODEL
Maximum size: A4 (210 mm × 297 mm)

Name of administration

EEC TYPE-APPROVAL CERTIFICATE IN RESPECT OF A SEPARATE TECHNICAL UNIT

(Article 9a of Council Directive 70/156/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers)

Separate technical unit: replacement exhaust system

EEC type-approval number of the separate technical unit (1) .....

1. Trade mark or trade name: .....
2. Type: .....
3. Manufacturer's name and address: .....
   .....
4. If applicable, name and address of the manufacturer's authorized representative: .....
   .....
5. Composition of the separate technical unit: .....
   .....
6. Trade mark or trade name of the type(s) of motor vehicle to which the silencer is to be fitted (2): .....
   .....
7. Type(s) of vehicle, ranging from serial No: .....
   to serial No: .....
8. Engine:
8.1. Type (positive ignition, diesel): .....
8.2. Cycles: two-stroke, four-stroke: .....
8.3. Total cylinder capacity: .....
8.4. Rated maximum engine power (3) ..... kW at ..... rev/min.
   .....
9. Number of gear ratios: .....
10. Gear ratios employed: .....
11. Drive-axle ratio(s): .....
12. Sound-level values:
   — moving vehicle ..... dB(A), speed stabilized before acceleration at ..... km/h;
   — stationary vehicle ..... dB(A), at ..... rev/min.

(1) Preceded by the distinctive letter(s) of the country granting type-approval: B = Belgium, D = Federal Republic of Germany, DK = Denmark, F = France, GR = Greece, I = Italy, IRL = Ireland, L = Luxembourg, NL = Netherlands, UK = United Kingdom.
(2) If several types are indicated, items 7 to 14 inclusive must be completed in respect of each type.
(3) Established in accordance with Directive 80/1269/EEC (OJ No L 375, 31. 12. 1980, p. 46).

13. Variation in back pressure: .....

14. Any restrictions in respect of use and mounting requirements: .....

.....

15. Date on which the model was submitted for the issue of an EEC type-approval certificate in respect of a separate technical unit: .....

.....

16. Technical service: .....

17. Date of the test report issued by that technical service: .....

18. Number of test report issued by that technical service: .....

19. EEC type-approval of the separate technical unit is hereby granted/refused (1): .....

20. Place: .....

21. Date: .....

22. Signature: .....

23. The following documents bearing the abovementioned type-apporval number of the separate technical unit in question are attached to this Annex (to be completed if necessary): .....

24. Remarks: .....

.....

(1) Delete where inapplicable.