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Item 4 of the provisional agenda

Regulation No. 59 (Replacement silencing system)

Proposal for draft amendments to Regulation No. 59

Submitted by the expert from the European Association of Automobile Suppliers *

The text reproduced below was prepared by the expert from the European Association of Automobile Suppliers (CLEPA) to include requirements on silencers or components filled with absorbing materials into Regulation No. 59 (see ECE/TRANS/WP.29/GRB/50, para. 16). The proposed amendments are mainly based on ECE/TRANS/WP.29/GRB/2008/5/Rev.2 and were prepared as a Revision to Regulation No. 59. Modifications to the current text of the Regulation are marked in bold characters.

* In accordance with the programme of work of the Inland Transport Committee for 2006–2010 (ECE/TRANS/166/Add.1, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

I. Proposal

"1. Scope

This Regulation covers replacement silencing systems for vehicles of categories M₁ and N₁.¹

2. Definitions

For the purpose of this Regulation:

- 2.1. "*Silencing system*" means a complete set of components necessary for limiting the noise produced by the engine of a motor vehicle and its exhaust;
- 2.2. "*Silencing system component*" means one of the separate components which together form the **silencing** system (e.g. silencer proper, expansion chamber, resonator);
- 2.3. "*Silencing system of different types*" means silencing systems which differ significantly in such respects as:
 - 2.3.1. That their components bear different trade names or marks;
 - 2.3.2. That the characteristics of the materials constituting a component are different or that the components differ in shape or size, a modification regarding the coating (**galvanization**, aluminium coating, etc.) is not **deemed** changing the type;
 - 2.3.3. That the operating principles of at least one component are different;
 - 2.3.4. That their components are **assembled** differently;
 - 2.3.5. **That the number of exhaust silencing systems or components is different.**
- 2.4. "*Replacement silencing system or components of said system*" means any part of the **silencing** system defined in paragraph 2.1. above intended for use on a vehicle, other than a part of the type fitted to this vehicle when submitted for type approval pursuant to this Regulation;
- 2.5. "*Design family of replacement silencing systems or replacement systems components*" means silencing systems or components thereof belong to the same design family if all of the following characteristics are the same:
 - (a) **The exhaust gases in contact with the absorbing fibrous material do not have gas flow through this material: (yes or no);**
 - (b) **The type of the fibres (e.g. basalt wool, biosil wool, glass wool, E-type wool, etc.);**
 - (c) **Binder material specifications (if applicable);**
 - (d) **Average fibre dimensions (thickness, length);**
 - (e) **Minimum bulk material packing density (kg/m³);**

¹ As defined in Annex 7 to the Consolidated Resolution on the Construction of Vehicles (R.E.3) (TRANS/WP.29/78/Rev.1/Amend.2, as last amended by Amend.4).

(f) **Maximum contact surface between the gas flow and the absorbing material (e.g. perforation open area).**

- 2.6. "Approval of a replacement silencing system or components of said system" means the approval of the whole or part of a silencing system adaptable to one or several specified types of motor vehicles, as regards the limitation of their noise level;
- 2.7. "Vehicle type" means a category of motor vehicles which do not differ significantly in such respects as:
- 2.7.1. The lines and constituent materials of the body (more particularly the engine compartment and its soundproofing);
- 2.7.2. The length and width of the vehicle;
- 2.7.3. The type of engine (positive ignition, compression ignition, two stroke or four stroke, reciprocating or rotary, **hybrid-electric engine type**), number and capacity of cylinders, number of carburettors **or injection system**, arrangement of valves, **rated** maximum power and corresponding engine speed (rpm) **or the type of the electric motor**;
- 2.7.4. Number and ratios of gears, total ratio of the transmission;
- 2.7.5. The number, type and arrangement of the exhaust systems;
- 2.7.6. The number, type and arrangement of the intake systems.

3. Application for approval

- 3.1. The application for approval of a replacement silencing system or components of said system shall be submitted by its manufacturer or by his duly accredited representative.
- 3.2. It shall be accompanied by the under mentioned documents in triplicate and the following particulars:
- 3.2.1. A description of the vehicle type(s) on which the system or components is intended to be mounted, with regard to the items mentioned in paragraph 2.7. above. The numbers and/or symbols identifying the engine type and the vehicle type shall be specified and the vehicle type approval number, if necessary;
- 3.2.2. A description of the assembled silencing system showing the relative position of each of its components, as well as mounting instructions;
- 3.2.3. Detailed drawings of each component to enable it to be easily located and identified, and a specification of the material used.
- 3.3. On request of the technical service conducting the tests for approval, the manufacturer of the silencing system shall submit:
- 3.3.1. **A sample** of the system or components submitted for approval;
- 3.3.2. A sample of the original silencing system with which the vehicle was equipped when submitted for type approval;
- 3.3.3. A vehicle representative of the type to which the system is to be fitted; **to be acceptable this vehicle shall satisfy the requirements of paragraph 8.1. of Regulation No. 51 (Conformity of Production). For the application of paragraph 8.1., the reference to paragraph 6. is limited to paragraphs 6.1. and 6.2.**

- 3.3.4. **When applicable**, a separate engine **and components** of at least the same cylinder capacity and power as that of the above-mentioned vehicle. **The engine will be equipped with the necessary means to run the tests specified under paragraph 6.3.4.1. and/or paragraph 6.4.3.**

4. Markings

- 4.1. Each component of the replacement silencing system, excluding tubes and mounting accessories, shall bear:
- 4.1.1. The trade name or mark of the manufacturer of the system or its components,
- 4.1.2. The commercial description given by the manufacturer.
- 4.2. Such markings shall be clearly legible and indelible.

5. Approval

- 5.1. If the type of replacement silencing system submitted for approval pursuant to this Regulation meets the requirement of paragraph 6. below, approval for that type shall be granted.
- 5.2. An approval number shall be assigned to each type approved. Its first two digits (at present **01 corresponding to the 01 series of amendments to the Regulation**) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party may not assign the same number to another type of replacement silencing system or component designed for the same type(s) of vehicle.
- 5.3. Notice of approval or of refusal of approval of a replacement silencing system or components of said system pursuant to this Regulation shall be communicated to the Parties to the Agreement which apply this Regulation, by means of a form conforming to the model in Annex 1 to the Regulation, and of drawings of the silencing system or components supplied by the applicant for approval, in a format not exceeding A4 (210 x 279 mm) or folded to that format and on an appropriate scale.
- 5.4. There shall be affixed to every component of silencing system conforming to a type approved under this Regulation an international approval mark consisting of:

- 5.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which had granted approval ²;
- 5.4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in paragraph 5.4.1.;
- 5.4.3. The approval number shall be mentioned in the approval form, as well as the method used for approval tests.
- 5.5. The approval mark shall be easily legible and indelible, when the silencing system is mounted on the vehicle.
- 5.6. A component may be marked with more than one approval number if it has been approved as a part of more than one replacement silencing system; in this case the circle need not be repeated. Annex 2 to this Regulation gives an example of the arrangement of the approval mark.

6. Specifications

- 6.1. General specifications
 - 6.1.1. The replacement exhaust system or components thereof **shall** be designed, constructed and capable of being mounted so as to ensure that the vehicle complies with the provisions of this Regulation under normal conditions of use, notwithstanding any vibrations to which it may be subject.
 - 6.1.2. The silencing system or components thereof **shall** be designed, constructed and capable of being mounted so that reasonable resistance to the corrosion phenomenon to which it is exposed is obtained having regard to the conditions of use of the vehicle.
- 6.2. Specifications regarding noise levels
 - 6.2.1. **Conditions of measurement**
 - 6.2.1.1. **The noise test of the silencing system and the replacement silencing system have to be executed with the same "normal" tyres (as defined in paragraph 2.8. of Regulation No. 117). The tests are not allowed to be done with "special use" tyres or "snow" tyres as defined in paragraphs 2.9. and 2.10. of Regulation No. 117. Such tyres would increase the noise**

² 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Serbia, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for the Russian Federation, 23 for Greece, 24 for Ireland, 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30 (vacant), 31 for Bosnia and Herzegovina, 32 for Latvia, 33 (vacant), 34 for Bulgaria, 35 (vacant), 36 for Lithuania, 37 for Turkey, 38 (vacant), 39 for Azerbaijan, 40 for The former Yugoslav Republic of Macedonia, 41 (vacant), 42 for the European Community (Approvals are granted by its Member States using their respective ECE symbol), 43 for Japan, 44 (vacant), 45 for Australia, 46 for Ukraine, 47 for South Africa, 48 for New Zealand, 49 for Cyprus, 50 for Malta, 51 for the Republic of Korea, 52 for Malaysia, 53 for Thailand, 54 and 55 (vacant), 56 for Montenegro, 57 (vacant) and 58 for Tunisia. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.

level of the vehicle or would have a masking effect on the noise reduction performance comparison. The tyres may be of used condition but shall satisfy legal requirements for in-traffic use.

- 6.2.2.** **The noise reduction performance** of the replacement silencing system or components of said system shall be verified by means of the methods described in paragraphs 6.2.1., 6.2.2. and 6.2.3. of Regulation No. 51. In particular, for the application of this paragraph, reference shall be made to the amendment level of Regulation No. 51 which was in force at the time of type approval of the new vehicle.

When the replacement silencing system or components thereof is mounted on the vehicle described in paragraph 3.3.3. above, the noise levels obtained using the two methods (stationary and running vehicle) shall satisfy one of the following conditions:

- (a) **Measurement with running vehicle**
- (i) **The value measured (rounded to the nearest integer) shall not exceed by more than 1 dB(A) the type approval value obtained under Regulation No. 51 with the type of vehicle concerned.**
 - (ii) **The value measured (before any rounding to the nearest integer) shall not exceed by more than 1 dB(A) the noise value measured (before any rounding to the nearest integer) on the vehicle referred to in paragraph 3.3.3. above, when this is fitted with a silencing system corresponding to the type fitted to the vehicle when submitted for type approval under Regulation No. 51.**

Where back-to-back comparison of the replacement system with the original system is chosen, for the application of paragraph 3.1.2.1.4.2. and/or paragraph 3.1.2.2.1.2. of Regulation No. 51, it is allowed to have a gear change to higher accelerations and the use of electronic or mechanical devices to prevent this downshift is not mandatory. If under these conditions the noise level of the test vehicle becomes higher than the conformity of production (COP) values, the technical service will decide on the representativeness of the test vehicle.

- (b) **Measurement with stationary vehicle**
- (i) **The value measured (rounded to the nearest integer) shall not exceed by more than 2 dB(A) the type approval value obtained under Regulation No. 51 with the type of vehicle concerned.**
 - (ii) **The value measured (before any rounding to the nearest integer) shall not exceed by more than 2 dB(A) the noise value measured (before any rounding to the nearest integer) on the vehicle referred to in paragraph 3.3.3. above, when this is fitted with a silencing system corresponding to the type fitted to the vehicle when submitted for type approval under Regulation No. 51.**

Where back-to-back comparison of the replacement system with the original system is chosen, for the application of paragraph 3.1.2.1.4.2. and/or paragraph 3.1.2.2.1.2. of Regulation No. 51, it is allowed to have a gear change to higher accelerations and the use of electronic or mechanical devices to prevent this downshift is not mandatory. If under these conditions the noise level of the test vehicle becomes higher than the COP values, the technical service will decide on the representativeness of the test vehicle.

- 6.3. Measurement of the vehicle performances
- 6.3.1. The replacement **silencing** system or components thereof **shall** be such as to ensure that vehicle performance is comparable with that achieved with the original equipment **silencing** system or component thereof.
- 6.3.2. The replacement silencing system or, depending on the manufacturer's choice, the components of said system shall be compared with an original silencing system or components, which are also in new condition, successively mounted on the vehicle mentioned in paragraph 3.3.3. above.
- 6.3.3. The verification shall be carried out by measuring the back pressure pursuant to paragraph 6.3.4. below.
- The value measured with the replacement silencing system shall not exceed the value measured with the original **silencing** system by more than 25 percent under the conditions mentioned below.
- 6.3.4. Test method
- 6.3.4.1. Test method with engine
- The measurements shall be conducted on the engine referred to in paragraph 3.3.4. above coupled to a dynamometer. With the throttle completely open, the bench shall be adjusted so as to obtain the engine speed (*S*) corresponding to the rated maximum power of the engine.
- For the measurement of back pressure, the distance at which the pressure tap shall be placed from the exhaust manifold is indicated in Annex 4 to this Regulation.
- 6.3.4.2. Test method with vehicle
- The measurements shall be carried out on the vehicle referred to in paragraph 3.3.3. above. The test shall be conducted either on the road or on a roller dynamometer.
- With the throttle completely open, the engine shall be loaded so as to obtain the engine speed corresponding to the rated maximum power of the engine (engine speed *S*).
- For the measurement of back pressure, the distance at which the pressure tap shall be placed from the exhaust manifold is indicated in Annex 4 to this Regulation.
- 6.4. Additional specifications regarding **replacement** silencing systems or components **containing acoustically absorbing** fibrous materials

6.4.1. General

Sound absorbing fibrous materials may be used in silencing systems or components **thereof only if**:

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

Unless one of these conditions is fulfilled, the complete silencing system or component thereof shall be submitted to conventional conditioning using one of the three installations and procedures **described below**.

6.4.1.1. Continuous road operation for 10,000 km

6.4.1.1.1. **50 ±20 percent** 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.

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

The complete test program **shall** include a minimum of 10 breaks of at least three-hour duration in order to reproduce the effects of cooling and any condensation which may occur.

6.4.1.2. Conditioning on a test bench

6.4.1.2.1. 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 paragraph 3.3. of this Regulation or the engine referred to in paragraph 3.4. of this Regulation. In the former case the vehicle shall be mounted on a roller dynamometer. In the second case, the engine shall be coupled to a dynamometer.**

6.4.1.2.2. 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.

6.4.1.2.3. 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*)**.

Each period shall comprise two **sequenced** sets of the six above-mentioned **conditions in consecutive order from (a) to (f)**.

6.4.1.2.4. During the test, the **silencing system or components thereof shall** not be cooled by a forced draught simulation 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.

- 6.4.1.3.** Conditioning by pulsation
- 6.4.1.3.1.** The **silencing system or components thereof shall be** fitted to the vehicle referred to in paragraph 3.3.3. **of this Regulation** or to the engine referred to in paragraph 3.3.4. **of this Regulation.** In the former case, the vehicle **shall** be mounted on a roller dynamometer, and, in the second case, the engine **shall** be mounted **on a dynamometer.**
- 6.4.1.3.2.** The test apparatus, a detailed diagram of which is shown in **figure 3 of the appendix to Annex 5 to Regulation No. 51 shall** be fitted at the outlet of the silencing system. Any other apparatus providing equivalent results is acceptable.
- 6.4.1.3.3.** The test apparatus shall 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.
- 6.4.1.3.4.** 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 **35 and 40 kPa.** It **shall close** when this pressure does not differ by more than 10 percent from its stabilized **value with the valve opened.**
- 6.4.1.3.5.** The time-delay switch shall be set for the duration of gas exhaust resulting from the provisions laid down in paragraph **6.4.1.3.4.** above.
- 6.4.1.3.6.** Engine speed shall be 75 percent of the speed (*S*) **at which the engine develops** maximum power.
- 6.4.1.3.7.** The power indicated by the dynamometer shall be 50 percent of the full-throttle power measured at 75 percent of engine speed (*S*).
- 6.4.1.3.8.** Any drain holes shall be closed off during the test.
- 6.4.1.3.9.** The entire test **shall** be completed within 48 hours. If necessary, one cooling period will be observed after each hour.
- 6.4.1.3.10.** After conditioning, the noise level is checked pursuant to paragraph 6.2. above.

7. Extension of approval

The silencing system manufacturer or his duly accredited representative may ask the administrative department which has granted the approval of the silencing system for one or several types of vehicles, for an extension of the approval to other types of vehicles.

The procedure is that described in paragraph 3. above. Notice of the extension of approval (or refusal of extension) shall be communicated to the Parties to the Agreement which apply this Regulation in accordance with the procedure specified in paragraph 5.3. above.

8. Modification of the type of silencing system

- 8.1. Every modification of the type of replacement silencing system shall be notified to the administrative department which approved the type of silencing system. The said department may then either:

- 8.1.1. Consider that the modifications made are unlikely to have an appreciable adverse effect, or
- 8.1.2. Require a further test report from the technical service responsible for conducting the tests.
- 8.2. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph 5.3. above to the Parties to the Agreement applying this Regulation.

9. Conformity of production

The conformity of production procedures shall comply with those set out in the Agreement, Appendix 2 (E/ECE/324-E/ECE/TRANS/505/Rev.2), with the following requirements:

- 9.1. Every replacement **silencing system bearing** an approval mark as prescribed under this Regulation shall conform to the type of silencing system approved and satisfy the requirements of paragraph 6. above. **For conformity of production purposes, the limit values set forth in paragraph 6. above apply with an additional margin of 1 dB(A).**
- 9.2. In order to verify conformity as prescribed in paragraph 9.1. above, adequate monitoring of the production shall be carried out.
- 9.3. The holder of the approval shall in particular:
 - 9.3.1. Ensure existence of procedures for the effective control of the quality of products;
 - 9.3.2. Have access to the control equipment necessary for checking the conformity of each approved type;
 - 9.3.3. Ensure that data of test results are recorded and that annexed documents shall remain available for a period to be determined in accordance with the administrative service;
 - 9.3.4. Analyze the results of each type of product in order to verify and ensure the stability of the product characteristics, making allowance for the variation of an industrial production;
 - 9.3.5. Ensure that for each type of product at least the tests prescribed in **Annex 5, paragraph 2.**, are carried out;
 - 9.3.6. Ensure that sampling or test pieces giving evidence of non-conformity with the type of test considered shall give rise to another sampling and another test. All the necessary steps shall be taken to re-establish the conformity of the corresponding production.
- 9.4. The competent authority which has granted type approval may at any time verify the conformity control method applicable to each production unit.
 - 9.4.1. At every inspection, the test books and production survey records shall be presented to the visiting inspector.
 - 9.4.2. The inspector may take samples at random which will be tested in the manufacturer's laboratory. The minimum number of samples may be determined according to the results of the manufacturer's own verification.
 - 9.4.3. When the quality level appears unsatisfactory or when it seems necessary to verify the validity of the tests carried out in application of paragraph 9.4.2.

above, the inspector shall select samples to be sent to the technical service which has **conducted type** approval tests.

- 9.4.4. The competent authority may carry out any test prescribed in this Regulation.
- 9.4.5. The normal frequency of inspections by the competent authority shall be one every two years. If unsatisfactory results are recorded during one of these visits, the competent authority shall ensure that all necessary steps are taken to re-establish the conformity of production as rapidly as possible.

10. Penalties for non-conformity of production

- 10.1. The approval granted in respect of a type of silencing system pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 9. above are not complied with, or if the silencing system or components fail to pass the tests provided for in paragraph 9.2. above.
- 10.2. If a Party to the Agreement which applies this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a copy of the approval form bearing at the end, in large letters, the signed and dated annotation "APPROVAL WITHDRAWN".

11. Production definitely discontinued

If the holder of the approval completely ceases to manufacture a type of replacement silencing system or components of the said system in accordance with this Regulation, he shall so inform the authority which granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Parties to the Agreement applying this Regulation, by means of a copy of the approval form bearing at the end, in large letters, the signed and dated annotation: "PRODUCTION DISCONTINUED".

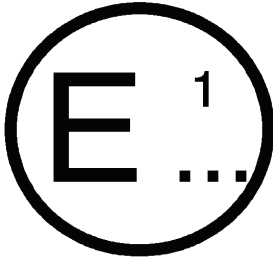
12. Names and addresses of technical services responsible for conducting approval tests, and of administrative departments

The Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the technical services responsible for conducting approval tests and of the administrative departments which grant approval and to which forms certifying approval **or extension** or refusal or withdrawal of approval, issued in other countries, are to be sent.

Annex 1

Communication

(Maximum format: A4 (210 x 297 mm))



issued by:

Name of administration:

.....
.....
.....

concerning the approval (or extension or refusal or withdrawal of approval or production definitely discontinued) of a type of replacement silencing system or components of the said system pursuant to Regulation No. 59

Approval No.:

1. Trade name or mark of the silencing system:
2. Type of the silencing system:
3. Manufacturer's name and address:
4. If applicable, name and address of manufacturer's representative:
5. Brief description of the silencing system (with/without ² fibrous material, etc.):
6. Trade name or mark of the vehicle type for which the silencing system is intended:
7. Vehicle type, starting from serial number:
8. Kind of engine (**e.g.** positive-ignition, compression ignition, **etc.**):
9. Cycles: two-stroke/four-stroke ²
10. Cylinder capacity:
11. Engine power (kW ECE):
12. Number of gears:
13. Gears used:
14. Final drive ratio(s):
15. Maximum power:
16. Load conditions of vehicle during test:

¹ Distinguishing number of the country which has granted/extended/refused/withdrawn an approval (see approval provisions in the Regulation).

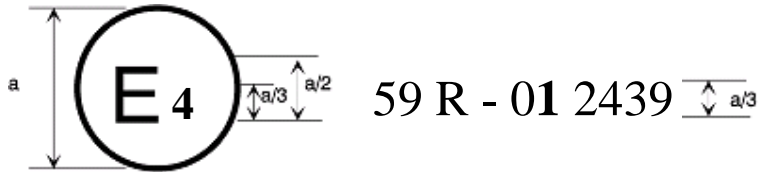
² Strike out what does not apply.

-
- 17. Sound levels:
 - 17.1. Vehicle in motion: db(A) at steady speed before acceleration of km/h
 - 17.2. Vehicle stationary: db(A) with engine running at min⁻¹
 - 18. Value of the back pressure:.....
 - 19. Silencing system submitted:
 - For approval on:.....
 - For extension of approval on:
 - 20. Technical Service responsible for conducting approval tests:
 - 21. Date of report issued by that service:.....
 - 22. Number of report issued by that service:
 - 23. Approval granted/refused ²:
 - 25. Place:
 - 26. Date:
 - 27. Signature:.....
 - 28. The following documents, bearing the approval number shown above, are annexed to this communication:
 - Drawings, diagrams and plans of the silencing system;
 - Photographs of the silencing system;
 - List of components, duly identified constituting the silencing system.

Annex 2

Arrangements of approval marks

(See paragraph 5.4. of this Regulation)



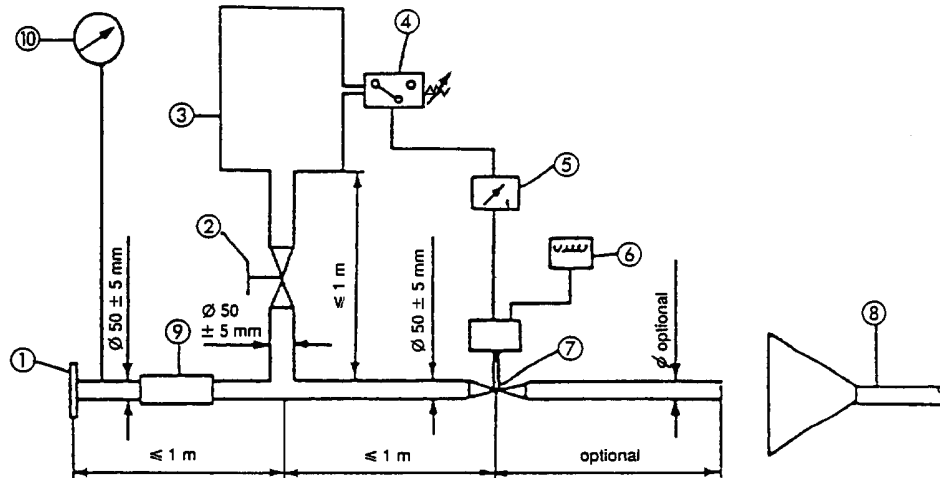
$a = 8 \text{ mm min}$

The above approval mark affixed to a component of silencing system shows that the replacement silencing system type concerned has been approved in the Netherlands (E4) pursuant to Regulation No. 59 under approval number 012439.

The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of Regulation No. 59 **as amended by the 01 series of amendments**.

Annex 3

Test apparatus



- 1 Inlet flange or sleeve – connection to the rear of complete silencing system to be tested.
- 2 Regulation valve (hand operated).
- 3 Compensating reservoir from 35 to 40 l.
- 4 Pressure switch **5 kPa to 250 kPa** – to open item 7.
- 5 Time delay switch – to close item 7.
- 6 Counter of impulses.
- 7 Quick response valve – such as the valve of an exhaust brake system of 60 mm in diameter, operated by a pneumatic cylinder with an output of 120 N at **400 kPa**. The response time, both when opening and closing, **shall** not exceed 0.5 s.
- 8 Exhaust gas evacuation.
- 9 Flexible pipe.
- 10 Pressure gauge.

Annex 4

Measuring points- Back pressure

Examples of possible measuring points for loss-of-pressure tests. The exact measuring point shall be specified in the test report. It shall be in an area where gas flow is regular.

Figure 1
Single pipe

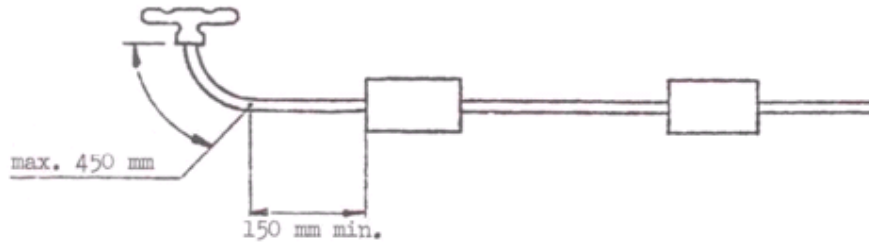


Figure 2
Partly twin pipe¹

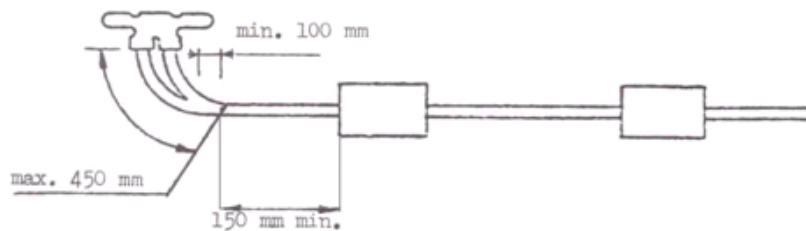
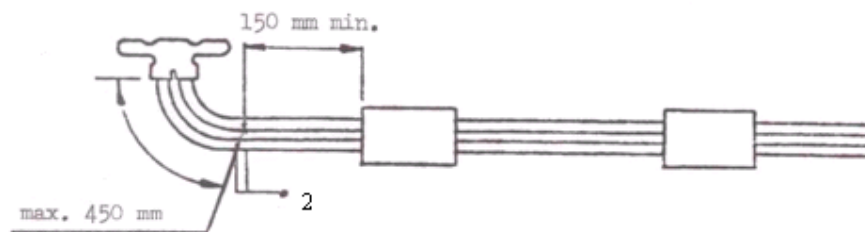


Figure 3
Twin pipe



¹ If not possible, refer to figure 3.

² Two measuring points, one reading.

Annex 5

Checks on conformity of production

1. General

These requirements are consistent with tests to be held to check conformity of production (COP), according to paragraphs 9.3.5 and 9.4.3. of this Regulation.

2. Testing **and** procedures

The methods of testing, measuring instruments and interpretation of results shall be those described in paragraph 6. of this Regulation. The exhaust system or component under test shall be subjected to the test as described in paragraphs 6.2., 6.3. and 6.4. **of this Regulation.**

3. **Sampling and evaluation of the results**

One silencing system or component has to be chosen and subjected to the tests of paragraph 2. above. If the test results fulfil the conformity of production requirements of paragraph 9.1. of this Regulation, the type of silencing system or component is considered to be in compliance with COP.

If one of the test results does not fulfil the conformity of production requirements of paragraph 9.1. of this Regulation, two more silencing systems or components of the same type shall be tested pursuant to paragraph 2. above.

If the test results for the second and the third silencing system or component fulfil the conformity of production requirements of paragraph 9.1. of this Regulation, the type of silencing system or component is considered in compliance with the conformity of production.

If one of the test results of the second or third silencing system or component does not fulfil the conformity of production requirements of paragraph 9.1. of this Regulation, the type of silencing system or component shall be considered not to conform to the requirements of this Regulation and the manufacturer shall take the necessary measures to re-establish the conformity."
