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Economic Commission for Europe**Inland Transport Committee****World Forum for Harmonization of Vehicle Regulations****Working Party on Noise and Tyres****Seventieth session**

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Item 5 of the provisional agenda

UN Regulation No. 59 (Replacement silencing systems)**Proposal for the 03 series of amendments to UN Regulation
No. 59****Submitted by the expert Germany***

The text reproduced below was prepared by the expert from Germany in accordance with discussions at the sixty-eighth and sixty-ninth sessions of the Working Party on Noise regarding transposition of the modified requirements for non-original replacement exhaust silencing systems (NORESS) from UN Regulation No. 92 (Replacement exhaust silencing systems for motorcycles) into UN Regulation No. 59. The modifications to the current text of UN Regulation No. 59 are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2018–2019 (ECE/TRANS/274, para. 123 and ECE/TRANS/2018/21/Add.1, Cluster 3), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

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I. Proposal

UN Regulation No. 59, amend to read:

"UN Regulation No. 59

Uniform provisions concerning the approval of replacement silencing systems

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** Page numbers will be added at a later stage.

1. Scope

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

2. Definitions

For the purpose of this Regulation:

- 2.1. "Silencing systems" means a complete set of components necessary for limiting the sound produced by an engine of a motor vehicle, its intake and its exhaust.;
- 2.2. "*Exhaust silencing system*" means a complete set of components necessary for limiting the sound produced by the engine of a motor vehicle and its exhaust of a motor engine;
- 2.3. "*Exhaust silencing system or exhaust silencing system component with variable geometry*" means an exhaust silencing system or exhaust silencing system component containing one or more moving parts or devices which, by changing the exhaust silencing system or exhaust silencing system component geometry, may change its sound reduction performance (e.g. moving parts or devices changing the noise reduction performances by opening or closing one or more valves in the exhaust gas flow as a function of varying driving or engine conditions (rpm, load, speed, etc.);
- 2.4. "*Exhaust silencing system component*" means one of the separate components which together form the exhaust silencing system (e.g. silencer proper, expansion chamber, resonator);
- 2.5. "*Exhaust silencing system of different types*" means exhaust silencing systems which significantly differ in respect of at least one of the following:
 - 2.5.1. Trade names or trademarks of their components;
 - 2.5.2. The characteristics of the materials constituting their components, except for the coating of those components;
 - 2.5.3. The shape or size of their components;
 - 2.5.4. The operating principles of at least one of their components;
 - 2.5.5. The assembly of their components;
 - 2.5.6. The number of exhaust silencing systems or components;
- 2.6. "*Exhaust replacement silencing system or components of said system*" means any part of the exhaust silencing system defined in paragraph 2.2. 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;

¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.6, para. 2 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

- 2.7. "*Design family of exhaust replacement silencing systems or replacement systems components*" means exhaust silencing systems or components thereof belonging to the same design family if all of the characteristics according to paragraph 6.4.1. are the same;
- 2.8. "*Approval of an exhaust replacement silencing system or components of said exhaust system*" means the approval of the whole or part of an exhaust silencing system adaptable to one or several specified types of motor vehicles, as regards the limitation of their noise level;
- 2.9. "*Vehicle type*" means a category of motor vehicles which does not differ in such essential respects as:
- 2.9.1. The type of engine (positive or compression ignition, two- or four-stroke, reciprocating or rotary piston), number and capacity of cylinders, number and type of carburettors or injection system, arrangement of valves or the type of electric motor;
- 2.9.2. "*Rated maximum net power*" P_n means the engine power expressed in kW and measured by the method pursuant to Regulation No. 85. However, if the rated maximum net power and the corresponding rated engine speed differs only due to different engine mappings, these vehicles may be regarded as from the same type;
- 2.9.3. The silencing system.

3. Application for approval

- 3.1. The application for approval of an exhaust 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 exhaust 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 exhaust silencing system showing the relative position of each of its components, as well as mounting instructions;
- 3.2.3. Detailed drawings of each exhaust silencing component to enable it to be easily located and identified, and a specification of the material used.
- 3.2.4. An information document according to the appendix of Annex 1.
- 3.3. On request of the Technical Service conducting the tests for approval, the manufacturer of the exhaust silencing system shall submit:
- 3.3.1. A sample of the exhaust silencing system or exhaust silencing components submitted for approval;
- 3.3.2. A sample of the original exhaust 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. A separate engine and components of at least the same cylinder capacity and rated maximum net power as that of the above-mentioned vehicle, when applicable. 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.
- 3.3.5. A type-approval number shall be assigned to each type of replacement silencing system, or components thereof, approved as a separate technical unit; section 3 of the type-approval number shall indicate the number of this Regulation. Furthermore, if the replacement silencing system is intended to be fitted on vehicle types complying with the limit values of Phase 1 as given in paragraph 6.2.2. of the 03 series of amendments of Regulation No. 51, the type-approval number shall be followed by the character "A". If the replacement silencing system is intended to be fitted on vehicle types complying with the limit values of Phase 2 as given in paragraph 6.2.2. of the 03 series of amendments of Regulation No. 51, the type-approval number shall be followed by the character "B". If the replacement silencing system is intended to be fitted on vehicle types complying with the limit values of Phase 3 as given in paragraph 6.2.2. of the 03 series of amendments of Regulation No. 51, the type-approval number shall be followed by the character "C". The same Contracting Party shall not assign the same number to another type of replacement silencing system, or components thereof.

4. Markings

- 4.1. Each component of the exhaust 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. The marking shall also include the character "A" if the replacement silencing system is intended to be fitted on vehicle types complying with the limit values of Phase 1 as given in paragraph 6.2.2. of the 03 series of amendments of Regulation No. 51, or the character "B" if the replacement silencing system is intended to be fitted on vehicle types complying with the limit values of Phase 2 as given in paragraph 6.2.2. of the 03 series of amendments of Regulation No. 51, or the character "C" if the replacement silencing system is intended to be fitted on vehicle types complying with the limit values of Phase 3 as given in paragraph 6.2.2. of the 03 series of amendments of Regulation No. 51. See Annex 2 for an example of the arrangement of approval mark.
- 4.3. Such markings shall be clearly legible and indelible.

5. Approval

- 5.1. If the type of exhaust 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 023 corresponding to the 023 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 an exhaust 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 exhaust silencing system or components supplied by the applicant for approval, in a format not exceeding A4 (210 x 297 mm) or folded to that format and on an appropriate scale.
- 5.4. There shall be affixed to every component of exhaust 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 approval²;
 - 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 exhaust 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 exhaust 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 exhaust replacement silencing system or components thereof shall be designed, constructed and capable of being mounted so as to ensure that the

² The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev. 6, Annex 3 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

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 exhaust silencing system or exhaust silencing 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, including regional climate differences.
- 6.1.3. Additional prescriptions related to tamperability and manually adjustable multi-mode exhaust silencing systems
 - 6.1.3.1. All exhaust silencing systems shall be constructed in a way that does not easily permit removal of baffles, exit-cones and other parts whose primary function is as part of the exhaust silencing/expansion chambers. Where incorporation of such a part is unavoidable, its method of attachment shall be such that removal is not facilitated easily (e.g. with conventional threaded fixings) and shall also be attached such that removal causes permanent/irrecoverable damage to the assembly.
 - 6.1.3.2. Exhaust silencing systems with multiple, manually adjustable operating modes shall meet all requirements in all operating modes. The reported sound levels shall be those resulting from the mode with the highest sound levels.
- 6.2. Specifications regarding sound levels
 - 6.2.1. Conditions of measurement
 - 6.2.1.1. The sound test of the exhaust silencing system and the exhaust replacement silencing system have to be executed with the same "normal" tyres, as defined in paragraph 2. of Regulation No. 117. The tests are not allowed to be done with "special use" tyres or "snow" tyres as defined in paragraph 2. of Regulation No. 117. Such tyres could increase the sound level of the vehicle or would have a masking effect on the sound reduction performance comparison. The tyres may be of used condition but shall satisfy legal requirements for in-traffic use.
 - 6.2.2. The sound reduction performance of the exhaust 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 point, 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.
 - (a) Measurement with running vehicle

When the exhaust replacement silencing system or components thereof is mounted on the vehicle described in paragraph 3.3.3. above, the sound levels obtained shall satisfy one of the following conditions:

 - (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 sound 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 an exhaust 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 exhaust 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 Annex 3 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

When the exhaust replacement silencing system or components thereof is mounted on the vehicle described in paragraph 3.3.3. above, the sound levels obtained shall satisfy one of the following conditions:

- (i) The value(s) 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(s) 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.

6.2.3. **Additional Sound Emission Provisions (ASEP)**

~~Further to the requirements of Annex 3 of the 03 series of amendments of Regulation No. 51, any exhaust replacement silencing system, or components thereof, shall fulfil the applicable specifications of Annex 7 of the 03 series of amendments of Regulation No. 51. For exhaust replacement silencing systems intended for vehicles type approved under the former series of the UN Regulation No. 51 the requirements of Annex 7 of the 03 series of amendments of Regulation No. 51 as well as the specifications of paragraphs 6.2.3.1. to 6.2.3.2. below do not apply.~~

~~6.2.3.1. Where the exhaust replacement silencing system, or components thereof, is a system or components with variable geometry, in the application for type approval the manufacturer shall provide a statement in conformity with the Appendix to Annex 7 of the 03 series of amendments of Regulation No. 51 that the exhaust silencing system type to be approved complies with the requirements of paragraph 6.2.3. of this Regulation. The approval authority may require any relevant test to verify the compliance of the exhaust silencing system type to the additional sound emission provisions.~~

~~6.2.3.2. Where the exhaust replacement silencing system, or components thereof, is not a system with variable geometry, it is sufficient in the application for type approval that the manufacturer provides a statement in conformity with~~

~~the appendix of Annex 7 of the 03 series of amendments of Regulation No. 51 that the exhaust silencing system type to be approved complies with the requirements of paragraph 6.2.3. of this Regulation.~~

- 6.2.3.1.** The ASEP requirements of paragraph 6.2.3. of Regulation No. 51 shall also be fulfilled for a NORESS, if it is designed to be used on vehicles that are type approved according to a series of amendments to UN Regulation No. 51, where ASEP was part of the issued type approval of the vehicle.

If ASEP has to be tested, these tests and necessary pre-tests have to be done in accordance with the series of amendments of UN Regulation No. 51, which was the basis for the issued type approval of the vehicle.

- 6.2.3.2.** If NORESS has different modes, sound actuators or variable geometries, it has to perform the ASEP tests of paragraph 6.2.3. of UN Regulation No. 51 also, if it is designed to be used on vehicles that are type approved according to a series of amendments to UN Regulation No. 51, where ASEP was not a part of the issued type approval of these vehicles.

These ASEP tests and necessary pre-tests have to be done in accordance with the actual series of amendments of the UN Regulation No. 51, which is the actual base for issuing type approvals of these vehicles.

The sound emission of the NORESS equipped vehicle under typical on-road driving conditions, which are different from those under which the type-approval test set out in Annex 3 and Annex 7 of UN Regulation No. 51 were carried out, shall not deviate from the test result in a significant manner.

- 6.2.3.3.** The ASEP tests regarding 6.2.3.2. have to be done in comparison on a vehicle, which is equipped with the original exhaust silencer and the NORESS (back-to-back-test). The ASEP tests, of the vehicle equipped with the original exhaust silencer, have to be done in normal operation mode for road use of the based sound emission approval of the vehicle. These test results build only the base of comparison with the ASEP test results of the NORESS equipped vehicle.

During these tests, the sound-pressure level of the NORESS for each test condition can have in its maximum the same sound-pressure level as the measurement of the vehicle equipped with the original exhaust silencer in its approved mode.

- 6.2.3.4.** If tests regarding 6.2.3.1. or 6.2.3.2. are to be performed for NORESS without multiple, manually or electronically adjustable, rider selectable operating modes, sound actuators or without variable geometries, the vehicle as described in paragraph 3.3.3. shall be used.

- 6.2.3.5.** If ASEP tests regarding 6.2.3.1. or 6.2.3.2. are to be performed for NORESS, which are equipped with multiple, manually or electronically adjustable, rider selectable operating modes, sound actuators or with variable geometries, each vehicle type of the range of approval application of the NORESS has to be tested in each selectable mode of the vehicle and the NORESS.

- 6.2.3.6.** ASEP tests regarding 6.2.3.4. can be done by the manufacturer of the NORESS.

ASEP tests regarding 6.2.3.5. have to be performed by the Technical Service. The test results of these measurements of the original and the NORESS equipped vehicle, and all relevant data of these tests have to be mentioned into the test report of the Technical Service.

- 6.2.3.7. The Type Approval Authority may require any relevant test to verify the compliance of the NORESS to the above mentioned requirements of paragraph 6.2.3.1. to 6.2.3.6. During these tests the type approval authority can also check the software of the steering units of the NORESS, which are equipped with multiple, electronically adjustable, rider selectable operating modes, sound actuators or with variable geometries.
- 6.2.3.8. The manufacturer shall provide in addition to the test report of the Technical Service a statement in conformity with the appendix of Annex 7 to UN Regulation No. 51 that the exhaust silencing system type to be approved complies with the requirements of paragraph 6.2.3. of this Regulation.
- 6.2.3.9. In the case of NORESS which are equipped with multiple, manually or electronically adjustable, rider selectable operating modes, sound actuators or with variable geometries the manufacturer of the NORESS has to send to the approval authority an additional documentation with detailed principle(s) and control of the NORESS in accordance to paragraph 6.2.4.
- 6.2.4. Additional documentation for NORESS equipped with multiple, manually or electronically adjustable, rider selectable operating modes, sound actuators or with variable geometries.
- 6.2.4.1. The additional documentation package required by paragraph 6.2.3.9. enabling the approval authority to evaluate the sound emission control strategy or strategies to ensure the correct operation of the NORESS.

It shall be made available in the two following parts:

- (a) the 'formal additional documentation package' that may be made available to interested parties upon request;
 - (b) the 'extended additional documentation package' that shall remain strictly confidential.
- 6.2.4.2. The formal additional documentation package may be brief, provided that it exhibits evidence that all parameters to control the NORESS have been identified. The additional documentation shall describe the functional operation of the NORESS. This material shall be retained by the approval authority.
- 6.2.4.3. The extended additional documentation package shall include information on the operation of all Additional Sound Emission Strategies (ASES) and the Base Sound Emission Strategy (BSES), including a description of the parameters that are modified by any ASES and the boundary conditions under which the ASES operate, and indication of which ASES and BSES are likely to be active under the conditions of the test procedures set out in the applicable ASEP requirement of UN Regulation No. 51. The extended documentation package shall include all modes of operation.

The extended documentation package shall remain strictly confidential. This material shall be retained by the Type Approval Authority.

- 6.3. Measurement of the vehicle performances
- 6.3.1. The exhaust replacement silencing system or components thereof shall be such as to ensure that vehicle performance is comparable with that achieved with the original equipment exhaust silencing system or component thereof.
- 6.3.2. The exhaust replacement silencing system or, depending on the manufacturer's choice, the components of said system shall be compared with an original equipment exhaust silencing system or exhaust silencing 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 exhaust replacement silencing system shall not exceed the value measured with the original exhaust 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 rated engine speed (S) corresponding to the rated maximum net 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 rated engine speed (S) corresponding to the rated maximum net 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.
- 6.4. 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 exhaust silencing systems or components thereof only if:
- (a) The exhaust gas is not in contact with the fibrous materials; or if

- (b) The exhaust 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 exhaust silencing system or component thereof shall be submitted to conventional conditioning using one of the three installations and procedures described below.

For the purposes of (b) above, a family of exhaust silencing system or exhaust silencing system 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.

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 programme 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 exhaust silencing system or components thereof shall be fitted to the vehicle referred to in paragraph 3.3.3. of this Regulation or 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. 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 exhaust 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 exhaust 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 exhaust 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 UN Regulation No. 51 shall be fitted at the outlet of the exhaust 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 its rated maximum net power.

6.4.1.3.7. The power indicated by the dynamometer shall be 50 percent of the full-throttle rated maximum net power measured at 75 percent of rated 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 exhaust silencing system manufacturer or his duly accredited representative may ask the Type Approval Authority which has granted the approval of the exhaust 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 exhaust silencing system

8.1. Every modification of the type of exhaust replacement silencing system shall be notified to the Type Approval Authority which approved the type of exhaust silencing system. The said Authority 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 exhaust replacement silencing system bearing an approval mark as prescribed under this Regulation shall conform to the type of exhaust 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 Type Approval Authority;

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

10. Information intended for users and technical inspection

Each replacement silencing system shall be accompanied by a paper document issued by the manufacturer of the replacement silencing system or their representative. That paper document shall at least bear the information according to Annex 6.

11. Penalties for non-conformity of production

- 11.1. The approval granted in respect of a type of exhaust 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 exhaust silencing system or components fail to pass the tests provided for in paragraph 9.2. above.
- 11.2. 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".

12. Production definitively discontinued

If the holder of the approval completely ceases to manufacture a type of exhaust replacement silencing system or components of the said system in accordance with this Regulation, he shall so inform the Type Approval 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".

13. Names and addresses of Technical Services responsible for conducting approval tests, and of Type Approval Authorities

The Contracting 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 Type Approval Authorities 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.

14. Transitional provisions

- 14.1. As from the official date of entry into force of the 03 series to this UN Regulation, no Contracting Party applying this UN Regulation shall refuse to grant or refuse to accept type approvals under the 03 series to this UN Regulation.**
- 14.2. As from 12 months after the date of entry into force, Contracting Parties applying this UN Regulation shall grant approvals only if the type of component or separate technical unit to be approved meets the requirements of the 03 series to this UN Regulation.**
- 14.3. As from 24 months after the date of entry into force, Contracting Parties applying this UN Regulation shall grant extensions to existing approvals only if the type of component or separate technical unit to be approved meets the requirements of the 03 series to this UN Regulation.**
- 14.4. Even after the entry into force of the 03 series of amendments to this UN Regulation, approvals of the components and separate technical units to the preceding series of amendments to the UN Regulation shall remain valid and Contracting Parties applying this UN Regulation shall continue to accept them.**

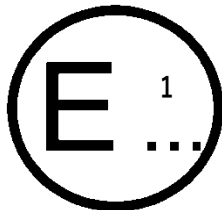
Annex 1

Communication

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

issued by: Name of administration:

.....



- Concerning: ² Approval granted
 Approval extended
 Approval refused
 Approval withdrawn
 Production definitively discontinued

of a type of exhaust replacement silencing system or components of the said system pursuant to Regulation No. 59

Approval No. Extension No.

1. Trade name or mark of the exhaust silencing system:
2. Type of the exhaust silencing system:
3. Manufacturer's name and address:
4. If applicable, name and address of manufacturer's representative:
5. Brief description of the exhaust silencing system (with/without² fibrous material, **variable geometries, sound actuator(s), adjustable modes** etc.):
-
6. Trade name or mark of the vehicle type for which the exhaust 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-stroke²
10. Cylinder capacity:
11. Rated maximum net power (kW):
12. Number of gears:

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

² Strike out what does not apply.

- 13. Gears used:
- 14. Final drive ratio(s):
- 15. Rated maximum net power:
- 16. Load conditions of vehicle during test:
- 17. Sound levels:
 - 17.1. Vehicle in motion: dB(A)
 - 17.2. Vehicle stationary: dB(A) with engine running at min⁻¹
- 18. Value of the back pressure:
- 19. Exhaust 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 exhaust silencing system;
 - Photographs of the exhaust silencing system;
 - List of components, duly identified constituting the exhaust silencing system.

Annex 1 - Appendix

Information document No. ... relating to type approval of exhaust replacement silencing systems or exhaust silencing components for motor vehicles (Regulation No. 59)

The following information, if applicable, shall be supplied in triplicate and include a list of contents. Any drawings shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Photographs, if any, shall show sufficient detail.

If the exhaust silencing systems or exhaust silencing components have electronic controls, information concerning their performance shall be supplied.

0. General
 - 0.1. Make (trade name of manufacturer):
 - 0.2. Type and general commercial description(s):
 - 0.3. Means of identification of type, if marked on the exhaust silencing systems or exhaust silencing components: ¹
 - 0.3.1. Location of that marking and method of affixing
 - 0.4. Company name and address of manufacturer:
 - 0.5. Address(es) of assembly plant(s):
 - 0.6. Name and address of the manufacturer's representative (if any):
1. Description of the vehicle(s) for which the device is intended (if the device is intended to be fitted to more than one vehicle type the information requested under this point shall be supplied for each type concerned)
 - 1.1. Make (trade name of manufacturer):
 - 1.2. Type and general commercial description(s):
 - 1.3. Means of identification of type(s), if marked on the vehicle:
 - 1.4. Category of vehicle(s):
 - 1.5. Vehicle type approval number(s):
 - 1.6. Power plant(s):
 - 1.6.1. Manufacturer of the engine:
 - 1.6.2. Manufacturer's engine code:
 - 1.6.3. Rated maximum net power (g): kW at min⁻¹
or maximum continuous rated power (electric motor): kW

¹ If the means of identification of type contains characters not relevant to describing the separate technical unit types covered by this information document, such characters shall be represented in the documentation by the symbol '?' (e.g. ABC??123??)

- 1.6.4. Pressure charger(s): original part or make and marking: ²
- 1.6.5. Air filter: original part or make and marking⁴:
- 1.6.6. Intake silencer(s): original part or make and marking: ⁴
- 1.6.7. Exhaust silencer(s): original part or make and marking: ⁴
- 1.6.8. Catalyst: original part or make and marking⁴:
- 1.6.9. Particulate Trap(s): original part or make and marking: ⁴
- 1.7. Transmission
- 1.7.1. Type (mechanical, hydraulic, electric, etc.):
- 1.8. Non-engine devices designed to reduce noise: original part or description: ⁴
- 1.9. Sound-level values:
 - moving vehicle: dB(A),
 - stationary vehicle dB(A), at min⁻¹ *in mode*²
 - stationary vehicle dB(A), atmin⁻¹ *in mode*²**
 - stationary vehicle dB(A), atmin⁻¹ *in mode*²**
 - stationary vehicle dB(A), atmin⁻¹ *in mode*²**
 - stationary vehicle dB(A), atmin⁻¹ *in mode*²**
- 1.10. Value of the back pressure: Pa
- 1.11. Any restrictions in respect of use and mounting requirements:
- 2. Remarks
- 3. Description of the device
- 3.1. A description of the replacement silencing system indicating the relative position of each system component, together with mounting instructions
- 3.2. Detailed drawings of each component, so that they can be easily located and identified, and reference to the materials used. These drawings shall indicate the place provided for the compulsory affixing of the type approval mark

Date:

Signed:

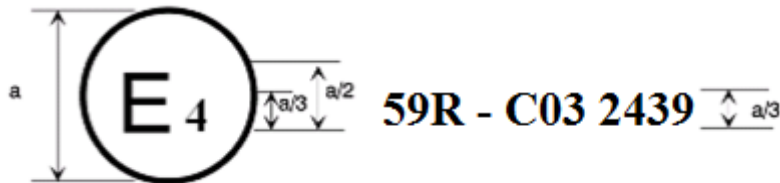
Position in company:

² Delete where not applicable.

Annex 2

Arrangements of approval marks

(See paragraph 5.4. of this Regulation)



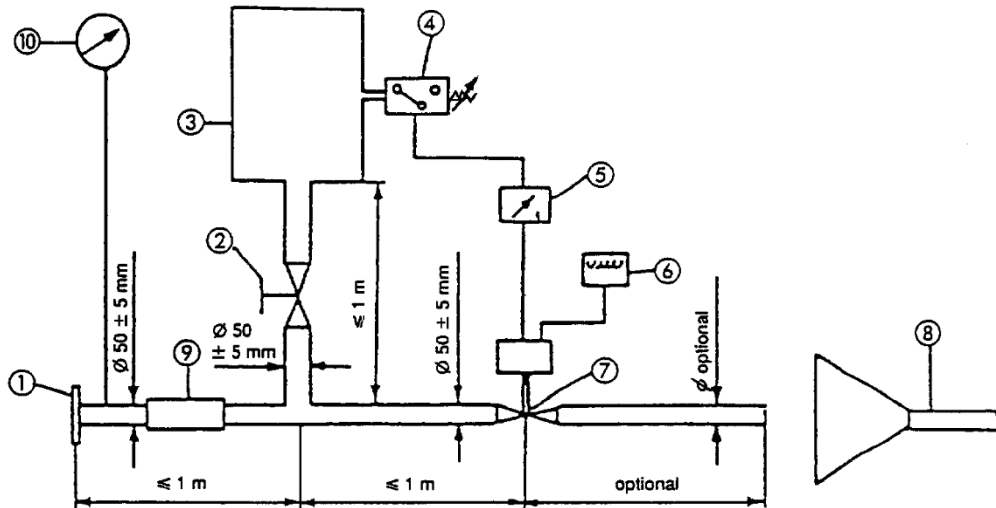
$a = 8 \text{ mm min}$

The above approval mark affixed to a component of exhaust silencing system shows that the exhaust replacement silencing system type concerned has been approved in the Netherlands (E 4) pursuant to Regulation No. 59 under approval number 032439.

The character C symbolizes that the approval was granted for the limit values according to phase 3 as given in paragraph 6.2.2. of the 03 series of amendments of the Regulation No. 51, followed by two digits of the approval number that indicate that the approval was granted in accordance with the requirements of Regulation No. 59 as amended by the 03 series of amendments.

Annex 3

Test apparatus



1. Inlet flange or sleeve – connection to the rear of complete exhaust 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

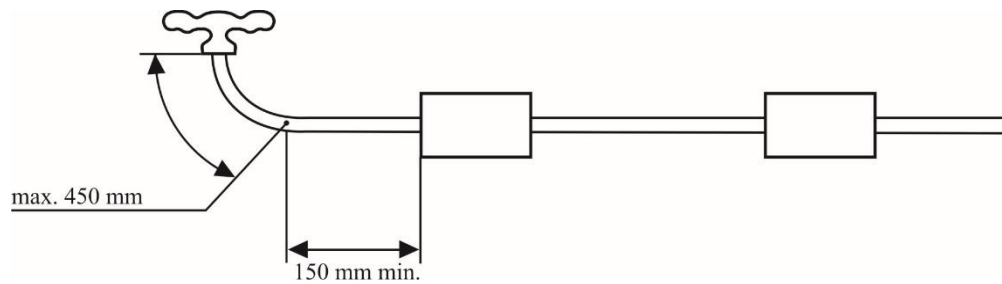


Figure 2
Partly twin pipe¹

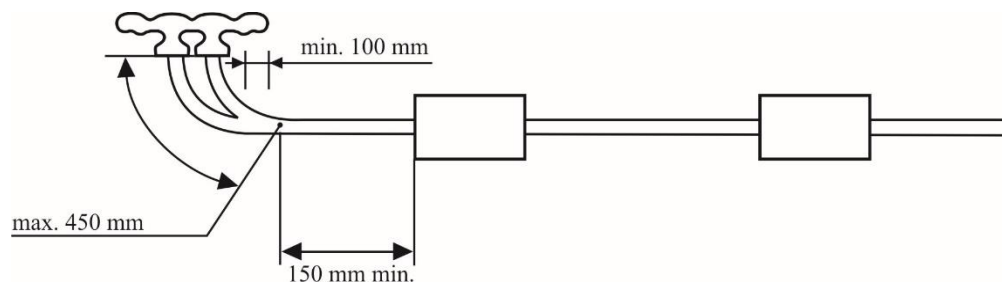
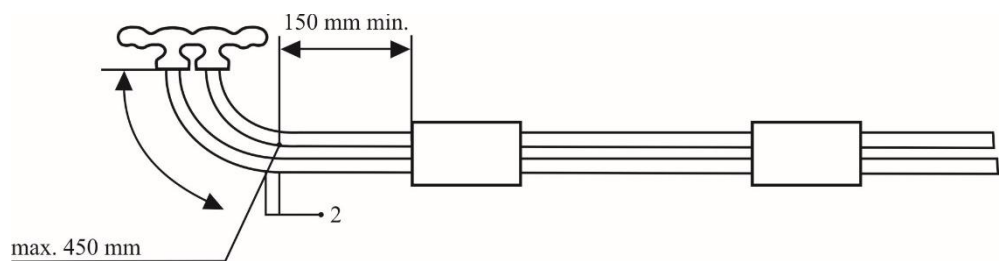


Figure 3
Twin pipe



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 exhaust silencing 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 exhaust silencing system or exhaust silencing 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 exhaust silencing system or exhaust silencing 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 exhaust silencing systems or exhaust silencing components of the same type shall be tested pursuant to paragraph 2. above.

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

If one of the test results of the second or third exhaust silencing system or exhaust silencing component does not fulfil the conformity of production requirements of paragraph 9.1. of this Regulation, the type of exhaust silencing system or exhaust silencing 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.

Annex 6

Information intended for users and technical inspection

1. Each exhaust replacement silencing system shall be accompanied by a document issued by the manufacturer of the exhaust replacement silencing system or their representative. That document shall at least bear the following information:
 - (a) The type-approval number of the exhaust replacement silencing system (the 5th section indicating the number of the extension of the type-approval can be omitted);
 - (b) The type-approval mark;
 - (c) Make (trade name of manufacturer);
 - (d) Type and commercial description and/or part number;
 - (e) Company name and address of manufacturer;
 - (f) Name and address of the manufacturer's representative (if any);
 - (g) Data of the vehicles for which the exhaust replacement silencing system is intended:
 - (i) Make;
 - (ii) Type;
 - (iii) Type-approval number;
 - (iv) Engine code;
 - (v) Rated maximum net power;
 - (vi) Kind of transmission;
 - (vii) Any restriction concerning the vehicles where the system can be mounted.
 - (h) Mounting instructions.
 2. If the document referred to in paragraph 1. consists of more than one page, all pages shall bear at least a reference to the type-approval number.
 3. The information concerning paragraphs 1 (g) and 1 (h) may be provided on the website of the manufacturer. In this case, the document accompanying the exhaust replacement silencing system shall indicate the website where the required information may be found and printed."
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II. Justification

General information

1. A lot of NORESS are designed for older M1 and N1 category vehicles which are not type approved according to the actual series of amendments to UN Regulation No. 51 (e.g. type approved before 2016). Because of that, NORESS for these vehicles have not been tested in respect of ASEP. Some of these NORESS use the technique of multiple, manually or electronically adjustable, rider selectable operating modes, variable geometries or with sound actuators (NORESS with “flexibilities”). Some of these “older vehicles” equipped with such NORESS with “flexibilities” produce low sound pressure levels only during the measurement conditions of Annex 3 to UN Regulation No. 51, 02 series of amendments or older (for a vehicle speed of 50 to around 60 km/h in second and third gears). Outside of the Annex 3 conditions, these approved NORESS with “flexibilities” often use a by-pass to the main-silencer or sound actuators to produce much higher sound pressure levels compared to the limits of paragraph 6. These NORESS with “flexibilities” extremely annoy people. In the future, each NORESS with “flexibilities” has to fulfil the ASEP requirements set out in UN Regulation No. 51. The test and type approval procedure of NORESS “without flexibilities” will not be influenced by the modifications of this proposal (unchanged manufacturer declaration procedure of ASEP). The modified paragraphs of this proposal transform the modifications of UN Regulation No. 92 also into UN Regulation No. 59.

Main text of the UN Regulation

2. Paragraph 6.2.3. will be modified into a headline for the following paragraphs.
3. Paragraph 6.2.3.1. is modified, that NORESS have to fulfil ASEP, if the NORESS is designed for vehicles, where ASEP is part of vehicle’s sound emission approval.
4. Paragraph 6.2.3.2. is modified in such a way that NORESS with “flexibilities” (different modes, sound actuators or variable geometries) have to fulfil the ASEP requirements of UN Regulation No. 51, even if the type approved M1/N1 vehicle (e.g. UN Regulation No. 51, 02 series of amendments) was not tested in accordance with ASEP.
In the second subparagraph of 6.3.3.2. it is mentioned which series of amendments to UN Regulation No. 51 builds the base of the ASEP tests. In the last subparagraph of 6.3.3.2. the last sentence of paragraph 6.2.3. of the 03 series of amendments to UN Regulation No. 51 was inserted, because the same need exists for NORESS, like for passenger cars, that the sound emission of “real use” shall not deviate from the test results of Annex 3 and Annex 7 of UN Regulation No. 51 in a significant manner.
5. The new paragraph 6.2.3.3. describes how the ASEP tests have to be done (back-to-back-test between OEM (original equipment manufacturer) and NORESS equipped vehicle) and what sound pressure level of a NORESS equipped vehicle is acceptable.
6. The new paragraph 6.2.3.4. describes the representative vehicle for the ASEP test of a NORESS without flexibilities (unchanged procedure).
7. The new paragraph 6.2.3.5. gives information how to test ASEP of NORESS with “flexibilities”.
8. The new paragraph 6.2.3.6. points out that the ASEP tests can be done by the manufacturer, if it is a NORESS without “flexibilities” (unchanged procedure). If it is a NORESS with “flexibilities” the ASEP tests have to be done by a Technical Service. It is also described which results and data of the ASEP tests has to be mentioned inside the test report of the Technical Service.

9. The new paragraph 6.2.3.7. describes the possibility of the Type Approval Authority to ask for any relevant test to verify the compliance with paragraphs 6.2.3.1 to 6.2.3.6.
10. Paragraphs 6.2.3.8. and 6.2.3.9. describe the additional documentation of NORESS “without and with flexibilities”, which the manufacturer has to deliver to the approval authority. For NORESS without “flexibilities”, the procedure is unchanged.
11. The new paragraph 6.2.4. and its sub-paragraphs 6.2.4.1. to 6.2.4.3. describe in detail the additional documentation package which has to be delivered in accordance with paragraph 6.2.3.9. by the manufacturer of the NORESS with “flexibilities” and the handling of this documentation inside the Type Approval Authority.
12. Paragraph 14 inserts transitional provisions which give detailed information about
- granting and acceptance of approvals according to the 03 series of amendments (paragraph 14.1.) from the official date of entry into force;
 - new approvals (paragraph 14.2.) which only can be granted if the NORESS to be approved fulfils the 03 series of this Regulation as from 12 months after the date of entry into force;
 - extensions of existing 02 series approvals (paragraph 14.3.) which only can be granted, if the NORESS to be approved meets the requirements of the 03 series as from 24 month after the official date of entry into force; and
 - validation of existing approvals according to the 02 series requirements after the entry into force of the 03 series of amendments to this UN Regulation.
13. Item 5 of Annex 1 (Communication form) is updated to give brief description of “variable geometries, sound actuator(s) and adjustable modes”, if applicable.

Annex 1, Appendix 1

14. Item 1.9. of the Appendix to Annex 1 (Sound level values: here stationary vehicle) is modified according to the proposal of Supplement 6 of UN Regulation No. 51. The test in accordance with stationary sound of UN Regulation No. 51 is required inside paragraph 6.2.2. of UN Regulation No. 59. If different modes produce different stationary sound pressure levels during the type approval procedure of UN Regulation No. 51, 03 series of amendments, each mode has to be listed inside the information document of UN Regulation No. 59, too.

Annex 2

15. The example of the approval number and explanations are adapted to the 03 series of amendments.
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