



CD/K/018:2008
ICS 43.040.20

EAST AFRICAN STANDARD

Replacement silencing systems for motor vehicles — Specification

EAST AFRICAN COMMUNITY

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

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Replacement silencing systems for motor vehicles — Specification

1 Scope

1.1 This specification covers silencing systems and silencing system components that are intended to be fitted as replacement parts to motor vehicles of categories M₁, M₂, M₃, N₁, N₂ and N₃.

1.2 It does not cover replacement silencing systems or silencing system components for motor vehicles of other categories or for motor cycles.

2 Normative references

The following referenced documents are indispensable for the application of this East African Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EAS 381, *Sampling procedures for inspection by attributes*

ISO 1585, *Determination of net power of internal combustion engines*

ISO 1585, *Road vehicles — Engine test code — Net power*

CD/K/040:2008, *Measurement of noise emitted by road vehicles when stationary — Code of practice*

CD/K/015:2008, *Code of practice — Measurement of noise emitted by motor vehicles*

EAS 392, *Quality management systems — Requirements*

3 Definitions

For the purposes of this specification the following definitions shall apply:

3.1 acceptable

Acceptable to the parties concluding the purchase contract, but in relation to the standardization mark and to inspections carried out by the relevant authority.

3.2 category M₁ motor vehicle

A motor vehicle used for the carriage of passengers and having at least four wheels, and which has seating accommodation for not more than eight passengers in addition to the driver of the vehicle.

3.3 category M₂ motor vehicle

A motor vehicle used for the carriage of passengers and having at least four wheels, having seating accommodation for more than eight passengers in addition to the driver, and having a maximum mass not exceeding 5 t

NOTE For the purposes of this specification, those motor vehicles with seating accommodation for more than 15 passengers (excluding the driver) are excluded.

3.4 category M₃ motor vehicle

A motor vehicle used for the carriage of passengers and having at least four wheels, having seating accommodation for more than eight passengers in addition to the driver, and having a maximum mass exceeding 5 t.

3.5

category N₁ motor vehicle

A motor vehicle having a maximum mass not exceeding 3.5 t, with at least four wheels or, provided the maximum mass exceeds 1 t, at least three wheels, and used for the carriage of goods.

3.6

category N₂ motor vehicle

A motor vehicle having a maximum mass exceeding 3.5 t, but not exceeding 12 t, and at least four wheels, and used for the carriage of goods.

3.7

category N₃ motor vehicle

A motor vehicle having a maximum mass exceeding 12 t, and at least four wheels, and used for the carriage of goods.

3.8

fibrous materials

Materials of a fibrous nature that are placed within the silencing system to limit the noise caused by the escape of the exhaust gases.

3.9

maximum rated power speed (u)

The engine speed at which the vehicle develops maximum power.

3.10

replacement silencing system or component

The entire silencing system or a silencing system component intended to be fitted as a replacement part to a vehicle.

3.11

silencing system

A complete set of components through which exhaust gases escape from the engine unit, including those components that are necessary to limit the noise caused by the escape of these gases.

3.12

silencing system component

One of the separate components that together form the silencing system.

3.13

vehicle type

A motor vehicle (of either category M₁, M₂, M₃, N₁, N₂ or N₃) that does not differ significantly in respect of the following:

- a) the lines and constituent materials of its bodies (more particularly the engine compartment and its soundproofing);
- b) the length and width of the vehicle;
- c) the type of engine (positive ignition, compression ignition, two-stroke or four-stroke, reciprocating or rotary), number and capacity of cylinders, number of carburettors or type of fuel injection equipment, arrangement of valves, maximum power and corresponding engine speed, etc.;
- d) the number and ratio of gears, and the total ratio of the transmission;
- e) the number, type and arrangement of the silencing system; and
- f) the number, type and arrangement of the air intake system.

4 Requirements

4.1 General requirements

- a) The replacement silencing system or component shall be so designed, constructed and capable of being mounted as to ensure that the vehicle, under normal conditions of use, complies with the requirements of the specification, notwithstanding any vibrations to which the vehicle may be subject.
- b) Where the routing of the replacement silencing system or component differs from that of the system originally fitted by the vehicle manufacturer, the routing shall not be prejudicial to the safety and legality of the vehicle.
- c) The replacement silencing system or component, as relevant, shall be so designed, constructed and capable of being mounted that acceptable resistance to the corrosion phenomenon to which it is exposed is obtained, the normal conditions of use of the vehicle being taken into account.¹⁾

4.2 Requirements for replacement silencing systems or components filled with fibrous materials

Absorbing fibrous materials may only be used in replacement silencing systems or components when it has been established (by appropriate means of design and manufacturing) that the efficiency of such a system in normal traffic conditions is sufficient to comply with the existing statutory provisions and their regulations.

4.3 Performance requirements

4.3.1 General

The performance of a replacement silencing system or component when fitted with fibrous materials and after having been conditioned in accordance with 6.2, shall be compatible with the appropriate engine or vehicle performance (as specified by the engine manufacturer or vehicle manufacturer) or comparable with the performance of the original equipment silencing system or component.

4.3.2 Back pressure

When a replacement silencing system or component is tested in accordance with 6.3,

- a) the measured value shall not exceed the limits specified by the engine manufacturer or vehicle manufacturer; or
- b) in cases where the manufacturer's specifications are not available, the back pressure shall not exceed by more than 25 % that value obtained using the original equipment silencing system or components.

4.3.3 Exhaust gas leakage

When a replacement silencing system or component is tested in accordance with 6.4, the exhaust gas leakage shall not exceed

- a) 20 L/min in the case of a component; and
- b) 50 L/min in the case of a complete silencing system.

4.3.4 Noise levels

When a replacement silencing system or component is tested in accordance with 6.5, the noise levels measured by using either of the two methods (drive-by or stationary) shall not exceed the maximum noise levels given in CD/K/040:2008 and CD/K/015:2008.

4.3.5 Engine power

When a replacement silencing system or component is tested in accordance with 6.6,

¹⁾ The replacement silencing system or component, as relevant, should carry a warranty against defective materials for a period of at least 12 months.

- a) the power loss shall not exceed the limits specified by the engine manufacturer or vehicle manufacturer; or
- b) in cases where the manufacturer's specifications are not available, the power loss shall not exceed 6 % of the power obtained when using a straight-through silencing system, and the back pressure shall not exceed the limits specified in 4.3.2(b).

5 Marking

5.1 Each component of the replacement silencing system, including pipes but excluding mounting accessories, shall be embossed, stamped or marked by other acceptable means, with the following information in legible and indelible printing:

- a) the manufacturer's name, trade name or trade mark;
- b) the relevant manufacturer's component part number.

6 Inspection and methods of test

6.1 Inspection

Visually examine each unit in the sample for compliance with all the relevant requirements of the specification for which tests to assess compliance are not given in 6.3 — 6.6 (inclusive).

6.2 Conditioning of replacement silencing systems or components filled with fibrous materials

6.2.1 General

The replacement silencing system or component, as relevant, is fitted to

- a) an engine that has similar characteristics to those of the engine fitted to the vehicle on which the silencing system or component is intended to be fitted; or
- b) a vehicle that is representative of the vehicle type to which the silencing system or component is designed to be fitted.

In the case of a vehicle, the vehicle is mounted on a roller dynamometer, and in the case of an engine, the engine is mounted on an engine dynamometer. The test apparatus described in 6.2.2 is fitted to the outlet of the silencing system.

6.2.2 Apparatus

- a) A typical test apparatus is detailed in Figure 1. Other test apparatuses that provide equivalent results are acceptable.
- b) The valve is opened when the exhaust gas pressure, measured at a minimum distance of 100 mm downstream of the intake flange, reaches a value of between 35 kPa and 45 kPa. The valve is closed when the pressure does not differ by more than 10 % from its stabilized value, measured when the valve is open.

6.2.3 Procedure

- a) Set the time delay switch to obtain the conditions given in 6.2.2(b).
- b) Set the engine speed at 75 % of the maximum rated power speed (u) as determined by the engine manufacturer or vehicle manufacturer.

NOTE 1 Ensure that the power indicated by the dynamometer is at least 50 % of the full throttle power measured at 75 % of maximum rated power speed (u).

NOTE 2 Ensure that the test duration does not exceed 48 h, even with cooling periods each hour.

- c) So adjust the conditioning apparatus that the exhaust gas flow is alternatively interrupted and reestablished by the quick response valve for 2 500 cycles.

6.3 Test for back pressure

6.3.1 Test with an engine

6.3.1.1 Apparatus

An engine (see 6.2.1 (a)) coupled to an engine dynamometer and fitted with the replacement silencing system or component to be tested.

6.3.1.2 Procedure

With the throttle completely open, so adjust the dynamometer as to obtain the maximum rated power speed (u) of the engine.

Measure the back pressure by fitting the pressure tapping at the distance from the exhaust manifold indicated in Figure 2(a), (b) or (c), as relevant.

6.3.2 Test with a vehicle

6.3.2.1 Apparatus

A vehicle (see 6.2.1(b)) mounted on a roller dynamometer and fitted with the replacement silencing system or component to be tested.

6.3.2.2 Procedure

With the throttle completely open, so adjust the dynamometer as to obtain the maximum rated power speed (u) of the engine.

Measure the back pressure by fitting the pressure tapping at the distance from the exhaust manifold indicated in Figures 2(a), (b) or (c), as relevant.

6.4 Test for exhaust gas leakage

Conduct the test prior to the application of any protective finish. Seal all inlet and outlet orifices but allow a connection point for compressed air.

Apply a constant air pressure of 30 ± 3 kPa to the component under test, and measure the air flow by means of a flowmeter connected into the air supply system.

6.5 Test for noise emission

Use the methods given in CD/K/015:2008 and CD/K/040:2008, but use the vehicle or engine, as relevant, described in 6.2.1.

6.6 Test for engine power

6.6.1 Apparatus

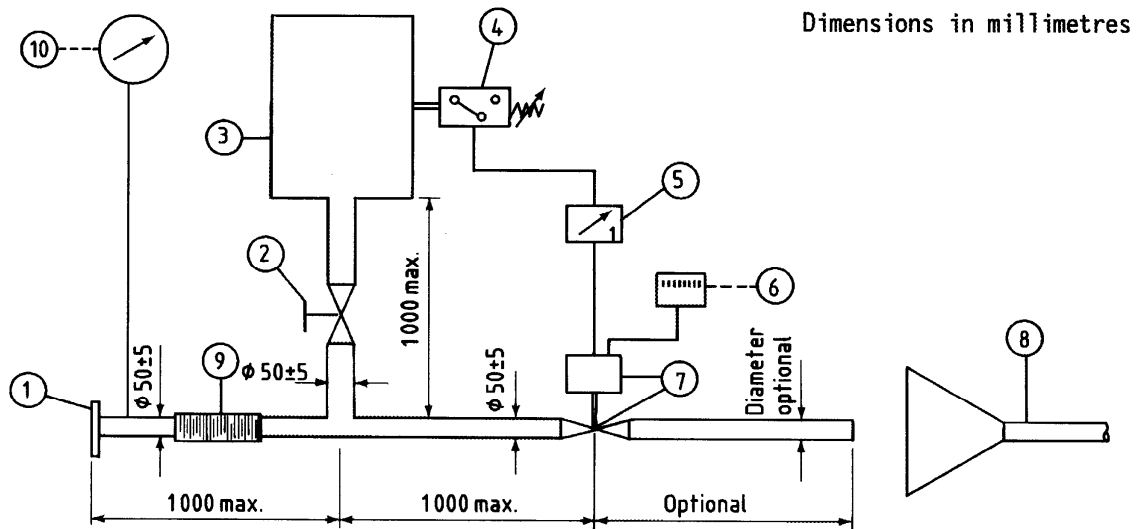
An engine dynamometer of size adequate to absorb the output from the engine under test.

6.6.2 Procedure

With the engine mounted on a test stand and connected to the dynamometer, conduct a power absorption test, using the method given in ISO 1585, with

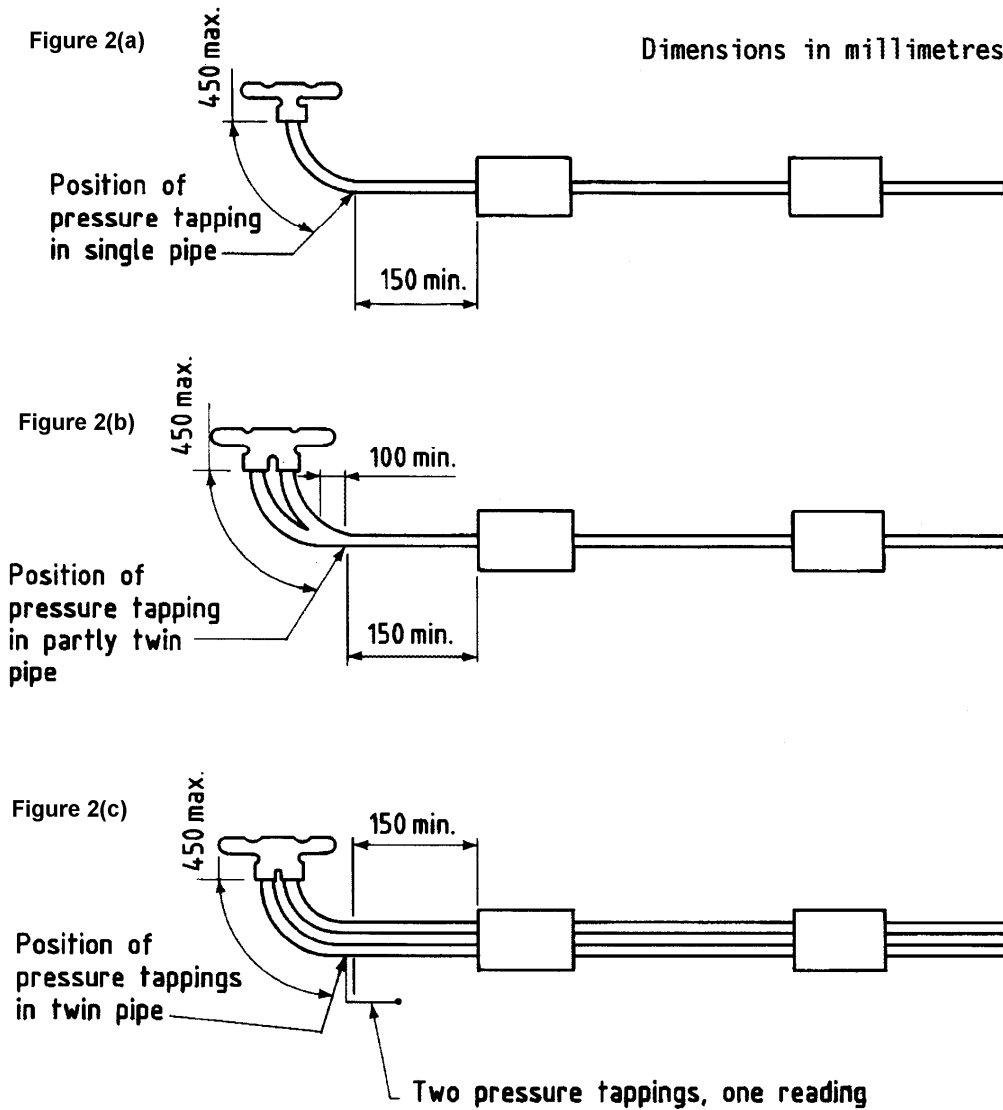
- a) a straight-through silencing system, and
- b) the replacement silencing system or component.

Compare the results so obtained. Alternatively, use a roller dynamometer and a vehicle as given in 6.2.1.



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

Figure 1 — Typical test apparatus



NOTE

- a) In the test report specify the exact position of the pressure tapping(s).
- b) The pressure tapping shall be positioned where the gas flow is regular²⁾

Figure 2 — Position of pressure tapping in test for back pressure

²⁾ If this is not possible, use the arrangement as shown in Figure 2(c).

Annex A
(informative)

Quality evaluation of replacement silencing systems produced to the requirements laid down in the specification

Standard

A.1 Quality verification

A.1.1 When a purchaser requires quality verification on an ongoing basis of replacement silencing systems or components, as relevant, produced to this specification, it is suggested that, rather than to evaluation of the final product only, he also direct his attention to the quality management system applied by the manufacturer. In this connection it should be noted that EAS 392 covers the provision of an integrated quality management system.

A.1.2 If the replacement silencing systems or components, as relevant, do not bear the standardization mark and no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of a lot, and a purchaser wishes to establish by inspection and testing of samples of the final product whether a lot (as defined in A.2.1) of the replacement silencing systems or components, as relevant, produced to this specification complies with its requirements, the sampling plan given in A.2 and based on the stated AQL's can be applied. (If a different AQL is required, reference should be made to applicable statistical sampling tables.)

It must be noted that

- a) such a sampling plan applies to fully manufactured replacement silencing systems or components, as relevant, only; and
- b) a lot that in terms of the plan is deemed to comply with the specification, could contain defective replacement silencing systems or components, as relevant, to an extent proportional to that permitted by the relevant acceptance numbers given in the sampling table.

A.2 Assessment of compliance with the specification

A.2.1 Definitions

acceptable quality level (AQL)

The maximum percentage defective that for the purpose of sampling inspection can be considered satisfactory as a process average.

Defective

A replacement silencing system or component, as relevant, that fails in one or more respects to comply with the relevant requirements of the specification.

Lot

Not less than three and not more than 3200 of the same replacement silencing systems or components, as relevant, from one manufacturer, submitted at any one time for inspection and testing.

A.2.2 Sampling

Use the sampling procedure given below to determine whether a lot complies with the specification, and deem the samples so taken to represent the lot for the respective properties.

- a) **Sample for inspection:** From the lot, draw at random (when applicable) the number of replacement silencing systems or components, as relevant, given in column 2 of Table A.1, relative to the appropriate lot size given in column 1.

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- b) **Sample for testing:** After inspection of the sample taken in accordance with (a) above, take from it, at random (when applicable), the appropriate number of replacement silencing systems or components, as relevant, given in column 4 of Table A.1.

Table A.1 — Sample sizes

1	2	3	4	5
Lot size, silencing systems or components	Sample for inspection		Sample for testing	
	Sample size, silencing systems or components	Acceptance No* (AQL = 4,0)	Sample size, silencing systems or components	Acceptance No.+ (AQL = 4,0)
3 - 25 26 - 90 91 - 150	3 13 20	0 1 2	3 3 3	0 0 0
151 - 280 281 - 500 501 - 1 200 1 201 - 3 200	32 50 80 125	3 5 7 10	13 13 13 20	1 1 1 2

* Based on EAS 381 using general inspection level II.
+ Based on EAS 381 using the sample size given for the particular lot size, and on general inspection level II.

A.3 Criteria of compliance

A.3.1 Deem the lot to comply with the relevant requirements of the specification if,

- a) on inspection of the sample taken in accordance with A.2.2(a), the number of defectives found does not exceed the relevant acceptance number given in column 3 of Table A.1; and
- b) on testing of the sample taken in accordance with A.2.2(b), the number of defectives found does not exceed the relevant acceptance number given in column 5 of Table A.1.

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