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## **EAST AFRICAN STANDARD**

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**Motor vehicle safety specification — Braking — Part 3: Energy sources and reservoirs**

**EAST AFRICAN COMMUNITY**

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## 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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## Motor vehicle safety specification — Braking — Part 3: Energy sources and reservoirs

### 1 Scope

This part of the specification covers the requirements for energy sources and energy reservoirs for compressed-air brakes and vacuum brakes on vehicles of categories M, N, and O (see CD/K/039-1:2008) that have a maximum design speed exceeding 25 km/h.

### 2 Definitions

For the purposes of this part of the specification, the definitions given in CD/K/039-1:2008 shall apply.

### 3 Requirements for energy reservoirs ("energy accumulators")

#### 3.1 Compressed-air braking devices

##### 3.1.1 Motor vehicles (categories M and N)

The capacity of, and the residual level of energy provided by the energy reservoir(s) of the compressed-air braking device(s) of a vehicle shall be such that, when a braking device is tested in accordance with 5.2.1,

- a) it is, in the final stage of the test, still possible to achieve, with the service braking device, a mean deceleration at least equal to the braking performance specified for the secondary (emergency) braking device (see CD/K/039-1:2008); and
- b) when relevant, the level of the energy produced in the trailer control line on the ninth application of the service brake control is at least 50 % of that obtained during the first application.

##### 3.1.2 Trailers and semi-trailers (category O)

The capacity of the energy reservoir(s) of the compressed-air braking device(s) of a trailer or semi-trailer shall be such that, when a braking device is tested in accordance with 5.2.2, the level of the energy produced in the trailer's brake cylinders on the ninth application of the service brake control is at least 50 % of that obtained during the first application.

#### 3.2 Vacuum braking devices

##### 3.2.1 Motor vehicles (categories M and N)

The capacity of, and the residual level of energy provided by the energy reservoir(s) of the vacuum braking device(s) of a vehicle shall be such that, when a braking device is tested in accordance with 5.3.1,

- a) it is, at the end of the test, still possible to achieve, with the service braking device, a mean deceleration at least equal to the braking performance specified for the secondary (emergency) braking device (see CD/K/039-1:2008); and
- b) when relevant, the final vacuum produced in the trailer control line is at least 50 % of the vacuum obtained on the first application of the service brake control.

##### 3.2.2 Trailers (category O)

The capacity of the energy reservoir(s) of the vacuum braking device(s) of a trailer or semi-trailer shall be such that, when a braking device is tested in accordance with 5.3.2, the level of energy produced at the trailer's brake on the final application is at least 50 % of that obtained on the first application of the service brake control.

## 4 Requirements for energy sources

### 4.1 Compressed-air braking devices

#### 4.1.1 General

The capacity of the air compressor of a compressed-air braking device of a motor vehicle shall be such that, when the device is tested in accordance with 5.4.1,

- a) the time  $T_2$  required to raise the air pressure in the least favoured reservoir from atmospheric pressure to the initial level of energy pressure  $P_2$  specified by the manufacturer or on the vehicle data plate, does not exceed
  - 1) 9 min in the case of a drawing vehicle, and
  - 2) 6 min in the case of other vehicles; and
- b) the time  $T_1$  required to raise the air pressure in the least favoured reservoir from atmospheric pressure to a pressure  $P_1 = 65\%$  of the pressure  $P_2$ , does not exceed
  - 1) 6 min in the case of a drawing vehicle, and
  - 2) 3 min in the case of other vehicles.

#### 4.1.2 Devices that incorporate auxiliary reservoirs

If the compressed-air braking device of a motor vehicle is equipped with auxiliary reservoirs having a total capacity greater than 20 % of the total capacity of the braking reservoirs, the capacity of the air compressor shall be such that, when the device is tested in accordance with 5.4.2,

- a) the time  $T_3$  required to raise the air pressure in the least favoured reservoir from atmospheric pressure to  $P_2$  does not exceed
  - 1) 11 min in the case of a drawing vehicle, and
  - 2) 8 min in the case of other vehicles; and
- b) during the period  $T_3$  there is no disturbance or irregularity in the functioning of the valves controlling the filling of the auxiliary reservoir(s).

### 4.2 Vacuum braking devices

The capacity of the energy source pump or the vehicle engine, as relevant, of a vehicle equipped with a vacuum braking device shall be such that, when the device is tested in accordance with 5.5, the time required to attain in the energy reservoir the initial level of vacuum specified by the manufacturer does not exceed

- a) 6 min in the case of a drawing vehicle with a vacuum feed line for a trailer or semi-trailer; and
- b) 3 min in the case of other vehicles.

## 5 Methods of test

### 5.1 Test conditions and preliminary procedures

#### 5.1.1 Determine, by inspection,

- a) the type of energy source, i.e. air compressor, vacuum pump, or vacuum from the engine itself; and

- b) in the case of a vehicle of category M or N that has compressed-air braking devices, whether any auxiliary reservoirs are fitted to the vehicle, and if so, whether their total capacity exceeds 20 % of the total capacity of the braking reservoirs.

**5.1.2** From the vehicle data plate or the manufacturer's published data, ascertain the initial level of energy  $P_2$ , pressure or vacuum, specified by the manufacturer for the energy reservoir(s) in the category M or N vehicle, or for the drawing vehicle of the trailer or semi-trailer, as relevant. Note the value of  $P_1$ , i.e. 65 % of  $P_2$ , and the engine speed at which maximum power output is obtained or, if the engine is controlled by a governor, the maximum speed permitted by the governor.

**5.1.3** In the case of a vehicle of category M or N that has compressed-air braking devices, by carrying out a preliminary test, determine which is the least favoured reservoir, i.e. the one in which the raising of the level of energy from zero to the manufacturer's specified initial level is the slowest, and use that reservoir in the actual tests given in 5.4.1.

**5.1.4** In the case of a category M or N vehicle which is a drawing vehicle for a trailer or semi-trailer, before starting the tests given in 5.4 and 5.5, simulate the trailer by coupling to the vehicle an energy reservoir of volume  $V$ , in litres, calculated as follows:

- a) For compressed-air braking devices:

$$\frac{PV}{100} = 20R$$

i.e.  $V = \frac{2000R}{P}$

where

$R$  = maximum load on the axle(s) of the trailer or semi-trailer,  $t$

$P$  = the maximum relative pressure that can be supplied through the feed circuit of the power-driven vehicle, kPa

- b) For vacuum braking devices:

$$V = 15R$$

where

$R$  = maximum load on the axle(s) of the trailer or semi-trailer,  $t$

## 5.2 Capacity of energy reservoirs of compressed-air braking devices

### 5.2.1 Vehicles of categories M and N

- a) Run the engine until the level of energy in the reservoir(s) is equal to the initial level of energy  $P_2$  (see 5.1.2).
- b) Block off any feeds to the reservoir(s) and auxiliary equipment.
- c) In the case of a drawing vehicle, shut off the feed line to the trailer or semi-trailer, connect to the control line an energy reservoir of capacity 0.5 L, and discharge the pressure in this energy reservoir before each application of the braking device.
- d) Apply the service brake control to its fullest extent nine times, noting
  - 1) the pressure in the service brake reservoirs when the control is released after the eighth application; and
  - 2) the level of energy produced in the trailer control line when the control is fully depressed on the first and last applications and check for compliance with 3.1.1 (b).

- e) Test the service braking performance on a road or on a dynamometer type brake-testing machine at the service brake reservoir pressures noted in terms of (d)(1) above, and check for compliance with 3.1.1 (a).

### 5.2.2 Trailers and semi-trailers

- a) With the trailer coupled to a suitable drawing vehicle or simulator that has, in both cases, an appropriate pressure range in the feed line, charge the system until the level of energy in the service brake reservoir(s) or simulator is equal to the initial level of energy  $P_2$  (see 5.1.2).
- b) Shut off the feed to the feed line, ensure that the trailer's energy reservoir or reservoirs are not replenished during the test, and isolate any auxiliary reservoir(s).
- c) Apply the service brake control of the drawing vehicle or the simulator to its fullest extent nine times, noting the energy level produced in the trailer's brake cylinders on the first and last applications.
- d) Check for compliance with 3.1.2.

### 5.3 Capacity of energy reservoirs of vacuum braking devices

#### 5.3.1 Vehicles of categories M and N

- a) Run the engine until the level of energy in the service brake reservoir(s) is equal to the initial level of energy  $P_2$  (see 5.1.2).
- b) Block off any feeds to the reservoir(s) and auxiliary equipment.
- c) In the case of a drawing vehicle, shut off the feed line to the trailer or semi-trailer, connect to the control line an energy reservoir of capacity 0,5 L, and deplete the vacuum in this reservoir before each application of the braking device.
- d) Apply the service brake control to its fullest extent
  - 1) nine times, if the energy source is a vacuum pump, and
  - 2) five times, if the energy source is the engine itself.
- e) Note
  - 1) the vacuum in the service brake reservoirs when the control is released after the eighth or fourth application, as relevant, and
  - 2) the vacuum produced in the control line when the control is fully depressed on the first and last applications, and check for compliance with 3.2.1 (b).
- f) Test the service braking performance on a road or on a dynamometer type brake-testing machine at the relevant service brake reservoir pressure noted in terms of (d)(1) above, and check for compliance with 3.2.1 (a).

#### 5.3.2 Trailers and semi-trailers

- a) With the trailer coupled to a suitable drawing vehicle or simulator that has, in both cases, an appropriate vacuum range in the feed line, charge the system until the level of energy in the service brake reservoir(s) or simulator is equal to the initial level of energy  $P_2$  (see 5.1.2).
- b) Shut off the feed to the feed line and isolate any auxiliary energy reservoir(s).
- c) Apply the service brake control of the drawing vehicle or the simulator to its fullest extent
  - 1) five times, when testing a trailer of category d or O<sub>2</sub>, and

- 2) nine times, when testing a trailer of category O<sub>3</sub> or O<sub>4</sub>.

Note the energy level produced at the trailer's brake on the first and last applications.

- d) Check for compliance with 3.2.2.

#### 5.4 Capacity of air compressors on vehicles of categories M and N

##### 5.4.1 General test

- a) Isolate any auxiliary energy reservoir(s).
- b) When relevant, attach the trailer simulator (see 5.1.4).
- c) Run the engine of the vehicle at the appropriate of the following (see 5.1.2):
  - 1) the speed corresponding to maximum power output,
  - 2) the maximum speed allowed by the governor.

Determine the times  $T_1$  and  $T_2$  for the pressure in the least favoured reservoir (see 5.1.3) to rise from atmospheric pressure to the pressure  $P_1$  and to the pressure  $P_2$ , respectively (see 5.1.2).

- d) Check for compliance with 4.1.1.

##### 5.4.2 Additional test for air compressors of devices that have auxiliary reservoirs of total capacity greater than 20 % of the total capacity of the braking reservoirs

- a) When relevant, attach the trailer simulator (see 5.1.4).
- b) Run the engine of the vehicle as in 5.4.1 (c), determine the time  $T_3$  for the pressure in the least favoured reservoir (see 5.1.3) to rise from atmospheric pressure to the pressure  $P_2$  (see 5.1.2) and, during this period, note whether any disturbance or irregularity occurs in the functioning of the valves controlling the filling of the auxiliary reservoir(s).
- c) Check for compliance with 4.1.2.

#### 5.5 Capacity of vacuum energy sources (pump or engine)

- a) When relevant, attach the trailer simulator (see 5.1.4).
- b) Run the engine of the vehicle at the appropriate of the following speeds:
  - 1) if the vacuum source is the vehicle engine, at the engine speed obtained with the vehicle stationary, neutral gear engaged, and the engine idling;
  - 2) if the vacuum source is a pump and the engine is not equipped with a governor, at the engine speed obtained with the engine running at 65 % of the speed corresponding to maximum power output;
  - 3) if the vacuum source is a pump and the engine is equipped with a governor, at the engine speed obtained with the engine running at 65 % of the maximum speed allowed by the governor.
- c) Determine the time required to attain, in the energy reservoir and from ambient atmospheric pressure, the initial level of vacuum specified by the manufacturer (see 5.1.2), and check for compliance with 4.2.

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