



**Economic and Social  
Council**

Distr.  
GENERAL

TRANS/WP.29/2002/15  
19 December 2001

Original: ENGLISH

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**ECONOMIC COMMISSION FOR EUROPE**

INLAND TRANSPORT COMMITTEE

World Forum for Harmonization of Vehicle Regulations (WP.29)  
(One-hundred-and-twenty-sixth session,  
12-15 March 2002, agenda item 4.2.5.)

PROPOSAL FOR DRAFT SUPPLEMENT 7 TO THE 03 SERIES  
OF AMENDMENTS TO REGULATION No. 36

(Large capacity passenger vehicles)

Transmitted by the Working Party on General Safety Provisions (GRSG)

Note: The text reproduced below was adopted by GRSG at its eighty-first session, and is transmitted for consideration to WP.29 and to AC.1. It is based on document TRANS/WP.29/GRSG/59, annex 2, as amended (TRANS/WP.29/GRSG/60, paras. 7 and 9).

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Paragraph 2.1., amend to read:

"2.1.            "Vehicle", means a single deck vehicle designed and equipped for the transport of more than 22 passengers. There are three Classes of vehicles. A vehicle may be regarded as belonging in more than one class. In such a case it may be approved for each class to which it corresponds;"

Insert a new paragraph 2.1.4., to read:

"2.1.4.        "Trolleybus", means a vehicle of Classes I, II, or III, electrically driven by energy from external wires."

Paragraph 2.1.4. (former), renumber as paragraph 2.1.5., and amend to read:

"2.1.5.        "Articulated vehicle" means ...."

Paragraph 2.1.5. (former), renumber as paragraph 2.1.6.

Paragraph 5.2.1.4., amend to read:

".... sections of an articulated vehicle to which ...."

Paragraph 5.5.4.5., amend to read:

"..... to the road surface, but never on any exhaust system or any high voltage electrical equipment."

Insert a new paragraph 5.5.5.3.4., to read:

"5.5.5.3.4. retrieving of trolley poles."

Paragraph 5.5.6.3., amend to read:

" ..... does not exceed 16 A. In the case where electronics are incorporated, these circuits may be protected by protection devices integrated into the electronic components or systems."

Paragraph 5.5.9., amend to read:

"..... permitted within 10 cm of any exhaust system component, any high voltage electrical equipment or any other significant source of heat of a vehicle unless the material is effectively shielded. For the purpose of this paragraph, a flammable material is considered to be one which is not designed to withstand the temperature likely to be encountered in that location. Where necessary, shielding shall be provided to prevent grease or other flammable materials coming into contact with any exhaust system, any high voltage electrical equipment or any other significant source of heat."

Paragraph 5.6.1.2., amend to read:

"..... rigid section of an articulated vehicle shall be ....  
articulated vehicle of Class I."

Paragraph 5.6.1.6., amend to read:

"..... section of an articulated vehicle shall be treated as a  
separate vehicle ..."

Paragraph 5.6.1.9., amend to read:

"..... in the case of Class I vehicles. There should not be any  
escape hatches fitted in the roof of any trolleybus. The minimum  
number of hatches shall be:"

Paragraph 5.9., amend to read:

"5.9.        Articulated section of articulated vehicles"

Paragraph 5.9.2., amend to read:

"5.9.2.     When the articulated vehicle at its unladen kerb mass ... "

Paragraph 5.9.4., amend to read:

"5.9.4.     On articulated vehicles, handrails and/or ...."

Paragraph 5.10.3., amend to read:

"..... (see annex 4, figure B) in the case of an articulated  
vehicle."

Paragraph 5.11., amend to read:

"5.11.       Direction holding of articulated vehicles"

Insert a new paragraph 5.16., to read:

"5.16.       Trolleybuses shall comply with the prescriptions of annex 8."

Insert a new annex 8, to read:

"Annex 8

SAFETY PRESCRIPTIONS FOR TROLLEYBUSES

1.            DEFINITIONS

For the purpose of this annex:

1.1. Contact system voltage

Trolleybuses can be supplied with contact system voltage of rated value of:

- 600 V (a working range of 400 to 720 V);
- 750 V (a working range of 500 to 900 V).

1.2. Electrical circuits of trolleybus

- (i) "high voltage circuits" means circuits supplied with contact system voltage;
- (ii) "low voltage" circuits means circuits supplied with accumulator battery voltage and with a charger outlet of nominal 24 V voltage.
- (iii) "three phase circuits" means circuits supplied with a second converter outlet of three phase voltage not exceeding 400 V AC.

1.3. Rated climatic conditions

Trolleybuses are intended to provide reliable transit service in the environmental conditions with:

- (a) a temperature range of minus 40 °Ñ to plus 40 °Ñ;
- (b) an relative humidity of 98 per cent at temperature of 25 °Ñ and lower;
- (c) an atmospheric pressure of 866 to 1,066 kPa;
- (d) altitude from sea level 1,000 m maximum

1.4. "Self extinguishing material" means a material which does not continue to burn when the ignition source is removed.

2. POWER COLLECTION

2.1. Electrical power from overhead wires is leaded to trolleybus with power collectors. The power collector is comprised of a pole, a trolley electric current collector and a replaceable collector insertion. Power collectors are hinged to trolleybuses, and turning in horizontal and vertical directions.

2.2. Poles shall be made of insulated material or metal covered with insulating material resistant to mechanical shocks.

2.3. Power collectors shall be designed to maintain adequate positive contact with the overhead trolley electric supply wires when the wires are located at 4 to 6 metres above the ground and trolleybus axis to axis deviation distance of at least 4.0 meters to each side with respect to the axis of the overhead wires.

2.4. In case the pole unwires, trolley electric current collector(s) shall not be raised higher than 7.2 metres above the road, or 1 meter maximum above electrical supplied lines at the time of

de-wiring, and shall not be declined lower than 0.5 metres above the roof of the trolleybus.

- 2.5. Each power collector shall be equipped with a device pulling the pole automatically down if the pole unwires.
- 2.6. The trolley electric current collector, if wrenched out of the pole, shall be kept connected to the pole and should not fall down.
- 2.7. Insulation resistance of the electric current collector to trolley bases shall be at least  $10 \text{ M}\Omega$ :
- 2.8. Power collectors may be equipped with remote control from the driver's compartment at least for unwiring.
- 2.9. Certain arrangements at the trolleybus shall provide an opportunity for the driver to replace, if necessary, power collector inserts in transit service conditions.

### 3. TRACTION AND AUXILIARY EQUIPMENT

- 3.1. Electrical components installed on the trolleybus shall be protected against over-voltage and short-circuit current. The protection shall preferably be assured by current-breaking apparatus that are reset automatically, remotely or manually.
- 3.2. Electrical components shall be protected against commutation or atmospheric over-voltage.
- 3.3. Current-breaking apparatus shall provide interruption of particular damaged circuits.
- 3.4. If any circuit includes single current-breaking apparatus, it shall be installed in the positive wire of the circuit.
- 3.5. All electrical circuits and circuit branches shall be of dual wiring. The trolleybus body can be used for current return grounds only for low voltage electrical circuits.
- 3.6. Battery cases, accumulator covers and battery compartment trays shall be made of non-flammable or self extinguishing materials.
- 3.7. Electrical components energized by the trolley line voltage shall have additional insulation from the body and transmission.
- 3.8. Electrical components with exemption of traction resistors shall be protected against penetration of moisture and dust inside the body and on insulated and current conducting parts.
- 3.9. At rated climate conditions for dry and clean trolleybus insulation resistance of electrical circuits when all rotating machines and apparatus are switched on shall not be less than:

- (i) body to high voltage electrical circuits  $5 \text{ M}\Omega$

(ii) high voltage electrical circuits to low electrical circuits 5 M $\Omega$

(iii) body to positive pole of low voltage electrical circuits 1 M $\Omega$

3.10. Wiring, cabling and apparatus

3.10.1. Only multi-line wires shall be used for high voltage circuits. All high voltage DC wiring shall have insulation rated for 3,000 V DC or AC.

3.10.2. Mounted wiring and cabling should not be stressed mechanically.

3.10.3. Wiring insulation shall not propagate burning.

3.10.4. Wiring of different voltages shall be mounted separately.

3.10.5. Cabling conduits shall be made of non-flammable material.

3.10.6. Cabling tubes located under the floor shall exclude propagation of water and dust.

3.10.7. Cabling and wiring located under the trolleybus shall be inserted into conduit protecting against water and dust.

3.10.8. Fastening and arrangement of wiring and cables shall exclude damage (fraying) of insulation.

Grommets of elastomeric material shall be provided at points where wiring penetrates metal structure to exclude insulation damage.

Radius of bound tubes containing wiring shall be five external diameters of the tube minimum.

3.10.9. Location of wiring in apparatus breaking off electrical current shall exclude skipping the electrical arch onto the wiring.

3.10.10. Precautions shall be taken to avoid damage of wiring and cables from heated resistors and other electrical components. In critical areas thermo-resistant wires or cables shall be used.

3.10.11. Wiring holders, connectors and other devices for mounting shall be made of non-flammable or self-extinguishing materials. Electrical components of the hardly flammable materials may be installed outside passenger compartment only.

3.10.12. Test voltage  $U_{test}$  for electrical equipment, wiring and cabling for high voltage circuits shall be of value of:

$$U_{test} = 2.5 U + 2,000 \text{ V AC,}$$

where U - rated voltage of the contact system

Test voltage for low voltage equipment  $U_{test} = 750 \text{ V AC.}$

The test voltage at frequency of 50 Hz shall be approximately sinusoidal form. The time of application of the test voltage is fixed at 1 min.

3.11. Electrical machines, apparatus, devices, wiring and cables shall withstand mechanical affects, applied to fixations, as follows:

- (i) sine-wave form vibration of 0.5 - 55 Hz frequency and 10 m/s<sup>2</sup> maximum amplitude including resonance if produced;
- (ii) discrete shocks of 30 m/s<sup>2</sup> peak shock acceleration lasting 2 - 20 ms in vertical direction.

4. ELECTRICAL SAFETY OF PASSENGERS AND SERVICE PERSONEL

- 4.1. At rated climate conditions for dry and clean trolleybus connected with both power collectors to wire of positive polarity and negative polarity of the contact system to "the ground" leakage current from the body shall not be higher than 0.2 mA (Grounded contact system).
  - 4.2. Trolleybus must be equipped with onboard device for permanent monitoring of leakage current or voltage between chassis and the road surface. The device shall disconnect the high voltage circuits from the contact system in case of leakage current exceeding 3 mA at a voltage of 600 V DC, or the voltage of more than 40 V.
  - 4.3. Stanchions at doorway shall be made of insulated material or plated with mechanically durable insulation. Insulation resistance shall at least be 1.0 M $\Omega$  on a contact square of 100  $\pm$  5 cm<sup>2</sup>.
  - 4.4. The first steps shall be made of insulated material or plated with mechanically durable insulation. Insulation resistance shall at least be 1.0 M $\Omega$  at a square of contact of 300  $\pm$  5 cm<sup>2</sup>.
  - 4.5. Door panels shall be made of insulated material or insulated from the trolleybus body. Insulation resistance shall be 1.0 M $\Omega$  at least at a contact square on the panel of 300  $\pm$  5 cm<sup>2</sup>.
  - 4.6. Sidewall area adjacent to the door apertures shall be plated with insulation. The insulated area shall extend at least 50 cm wide each side of the door apertures and at least 200 cm high from the roadway. Insulation resistance in respect to the trolleybus body shall not be less than 1.0 M $\Omega$  at a square of contact of 200  $\pm$  5 cm<sup>2</sup>.
  - 4.7. If the trolleybus is equipped with a double insulated AC/DC converter, paragraphs 4.3 to 4.6 need not be applied.
5. THE DRIVER'S COMPARTMENT
- 5.1. In the driver's compartment there should not be high voltage equipment accessible for the driver.

- 5.2. As a minimum, the instrument panel shall be consistent of:
- (a) indicator of voltage in the contact system;
  - (b) indicator of zero voltage in the contact system;
  - (c) indicator of main automatic switch of contact system voltage state;
  - (d) indicator of charge/discharge of the batteries;
  - (e) indicator of dangerous potential on the body or leakage current exceeding permissible value."
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