

**UNITED  
NATIONS**

**E**



**Economic and Social  
Council**

Distr.  
GENERAL

TRANS/WP.29/GRSG/2005/  
7 December 2004

Original: ENGLISH

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**ECONOMIC COMMISSION FOR EUROPE**

INLAND TRANSPORT COMMITTEE

World Forum for Harmonization of Vehicle Regulations (WP.29)

Working Party on General Safety Provisions (GRSG)

(Eighty-eighth session, 18-22 April 2005,  
agenda item 3.)

PROPOSAL FOR AMENDMENT TO THE DRAFT 02 SERIES OF AMENDMENTS TO  
REGULATION No. 107

(M2 and M3 vehicles)

Transmitted by the expert from the International Organization of  
Motor Vehicle Manufacturers (OICA)

Note: The text reproduced below was prepared by the expert from OICA, at the request of the eighty-seventh session, in order to improve the presentation of the requirements applying to trolleybuses. It also clarifies the application of the annex to certain trolleybus derivatives.

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Note: This document is distributed to the Experts on General Safety Provisions only.

## A. PROPOSAL

Amend paragraph 2.1.8., to read:

"2.1.8.            "Trolleybus" means a **vehicle**, electrically driven by energy from external, overhead **contact** wires. **For the purposes of this Regulation, it also includes such vehicles having an additional internal means of propulsion (dual mode vehicles) or having a means of external guidance (guided trolleybuses).**"

Amend annex 12, to read:

### "Annex 12

#### **ADDITIONAL SAFETY PRESCRIPTIONS FOR TROLLEYBUSES**

##### 1.            **DEFINITIONS AND OPERATING PARAMETERS**

For the purpose of this annex:

1.1.            "**Line voltage**" means the voltage provided to the vehicle from the external power supply.

Trolleybuses **shall be designed to operate at a rated line voltage** of either:

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

1.2.            **The electrical circuits of a trolleybus are classified as:**

1.2.1            "high voltage circuits" means circuits **energised at line** voltage;

1.2.2            "low voltage circuits" means circuits **energised at a nominal voltage of 12 V, 24 V or 42 V**.

1.2.3            "three phase circuits" means circuits supplied with a **three-phase** voltage not exceeding 400 V AC.

1.3.            Rated climatic conditions

Trolleybuses **shall be designed to operate reliably under the following environmental conditions:**

1.3.1            a temperature range of minus 40 C to plus 40 C;

1.3.2            a relative humidity of 98 per cent at temperatures **up to** 25 C;

1.3.3            an atmospheric pressure **range** of 866 **kPa** to 1,066 kPa;

- 1.3.4 an altitude **range** from sea level to a **maximum of 1,000 m above sea level**.
- 1.4. "**Self-extinguishing material**" means a material **that** does not continue to burn when the ignition source is removed.
2. POWER COLLECTION
- 2.1. Electrical power **shall be obtained** from the **contact wires by means of one or more power collection devices, normally comprising two trolley booms. (A single trolley boom or a pantograph may be used in guided applications). A trolley boom shall consist of a roof mounting (trolley base), a pole, an electrical power collector (trolley head) and a replaceable contact surface insert. Trolley booms shall be mounted so that they can turn in both horizontal and vertical directions.**
- 2.2. Poles shall be made of **an** insulated material or **of** metal covered with insulating material **and shall be** resistant to mechanical shocks.
- 2.3. Power collectors shall be designed to maintain adequate positive contact with the **contact** wires when the wires are located at **between 4 and 6 metres** above the ground and, **in the case of trolley booms, to allow the longitudinal axis of the trolleybus to deviate** at least 4.0 metres to **either side of the mean** axis of the **contact** wires.
- 2.4. **If the power collector becomes accidentally detached from the contact wire (de-wired), the upper end of the power collector(s) shall not be raised higher than 7.2 metres above the road, or 1 metre maximum above the contact wires at the time of de-wiring, nor lower than 0.5 metres above the roof of the trolleybus.**
- 2.5. Each **trolley boom** shall be equipped with a device **which retracts the boom automatically** if the pole unwires.
- 2.6. The trolley **head**, if **dismounted from its normal position on** the pole, shall be **remain attached** to the pole and **must** not fall down.
- 2.7. **The** insulation resistance **between** the electric power collector **and the roof mounting/trolley base** shall be at least 10 MΩ:
- 2.8. Power collectors may be equipped with remote control from the driver's compartment, at least for **retraction**.
- 2.9. **Provision shall be made to enable** the driver to replace, if necessary, **contact surface inserts while the vehicle is in operation on the road.**

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 **circuit breakers** that are reset automatically, remotely or manually.
- 3.2. Electrical components shall be protected against commutation or atmospheric over-voltage.
- 3.3. **Circuit breakers** shall provide interruption of particular damaged circuits.
- 3.4. If any circuit includes a **single-pole circuit breaker**, 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 **earth return** only for low voltage **circuits**.
- 3.6. Battery **cases, covers and trays** shall be made of non-flammable or self-extinguishing materials.
- 3.7. Electrical components energized **at the line voltage** shall have additional insulation from the **vehicle**.
- 3.8. Electrical components, with **the exception** of traction resistors, shall be protected against penetration of moisture and dust **into** the body and **onto** insulated and current conducting parts.
- 3.9. **Within the** rated climate conditions, **with the trolleybus** dry and clean, **the** insulation resistance of electrical circuits, when all rotating machines and apparatus are switched on, shall not be less than:
- |              |   |              |
|--------------|---|--------------|
| <b>3.9.1</b> | body to high voltage <b>circuits</b>                        | 5 M $\Omega$ |
| <b>3.9.2</b> | high voltage <b>circuits</b> to low <b>voltage circuits</b> | 5 M $\Omega$ |
| <b>3.9.3</b> | body to positive pole of low voltage <b>circuits</b>        | 1 M $\Omega$ |
- 3.10. **Wiring** and apparatus
- 3.10.1. Only multi-**core** 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 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. **Wiring** conduits shall be made of non-flammable material.
- 3.10.6. **[Reserved]**
- 3.10.7. **Wiring** located under the **floor of the** trolleybus shall be **contained in** conduit **that protects it against the ingress and propagation of** water and dust.
- 3.10.8. Fastening and arrangement of wiring and cables shall **be designed to prevent** damage **by abrasion (chafing)** of insulation. Grommets of elastomeric material shall be provided at points where wiring penetrates metal structure. **The bend radius of conduits** containing wiring shall be **at least five times the** external **diameter** of the **conduit**.
- 3.10.9. **The location** of wiring in **the vicinity of circuit breakers** shall **be designed so as to prevent arcing** onto the wiring.
- 3.10.10. Precautions shall be taken to avoid damage of **wiring** from heated resistors and other electrical components. In critical areas thermo-resistant **wires** shall be used.
- 3.10.11. Wiring holders, connectors and other **mounting devices** shall be made of non-flammable or self-extinguishing materials. Electrical components of the **self-extinguishing** materials **shall only be** installed outside **the passenger compartment**.
- 3.10.12. **All electrical circuits shall undergo an excess voltage test**. The test voltage **shall be AC with a** frequency of 50 Hz **and** approximately sinusoidal form. The time of application of the test voltage **shall be** 1 min.
- 3.10.12.1** **The test** voltage  $U_{\text{test}}$  for electrical equipment **and wiring** for high voltage circuits shall **be**:
- $$U_{\text{test}} = 2.5 U + 2,000 \text{ V AC},$$
- where **U is the rated line voltage**
- 3.10.12.2** **The test** voltage for low voltage **circuits shall be**  $U_{\text{test}} = 750 \text{ V AC}$ .
- 3.11. Electrical machines, apparatus, devices **and wiring** shall withstand mechanical **loads**, applied to **mounting points**, as follows:
- 3.11.1** sine-wave form vibration of 0.5 - 55 Hz frequency and  $10 \text{ m/s}^2$  maximum amplitude including resonance if produced;
- 3.11.2** **vertical** discrete shocks of  $30 \text{ m/s}^2$  peak shock acceleration lasting 2 - 20 ms.
4. **ELECTRICAL SAFETY OF PASSENGERS AND CREW**

- 4.1. At **the** rated climate conditions, **with the trolleybus** dry and clean and connected to **both positive and negative power supply via the power collection devices, the earth** leakage current from the body shall not be higher than 0.2 mA.
- 4.2. **The trolleybus** must be equipped with **an** onboard device for permanent monitoring of leakage current or voltage between **the** chassis and the road surface. The device shall disconnect the high voltage circuits from the contact system **if the** leakage current **exceeds** 3 mA at a **line** voltage of 600 V DC, or **if** the voltage **exceeds** 40 V.
- 4.3. Stanchions **and handrails** at doorways shall be made of insulating material or **covered** with mechanically durable insulation or insulated from the trolleybus body. **The** insulation resistance shall at least be 1.0 MΩ **over** a contact **area** of  $100 \pm 5 \text{ cm}^2$ .
- 4.4. The first steps shall be made of insulating material or **covered** with mechanically durable insulation. **The** insulation resistance shall at least be 1.0 MΩ **over a contact area** of  $300 \pm 5 \text{ cm}^2$ .
- 4.5. Door panels shall be made of insulating material or insulated from the trolleybus body. **The** insulation resistance shall be **at least** 1.0 MΩ **over a contact area** on the panel of  $300 \pm 5 \text{ cm}^2$ .
- 4.6. **The external body panels** adjacent to the door apertures shall be **covered** with insulating material. The insulated area shall extend **in width** at least 50 cm **each** side of the door apertures and **in height** at least 200 cm **from** the roadway. **The** insulation resistance in respect to the trolleybus body shall not be less than 1.0 MΩ **over a contact area** of  $200 \pm 5 \text{ cm}^2$ .
- 4.7. If the trolleybus is equipped with double-insulated converters, 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 **any** high voltage equipment accessible **by** the driver.
- 5.2. As a minimum, the instrument panel shall **include**:
- 5.2.1 indicator of voltage in the contact system;
- 5.2.2 indicator of zero voltage in the contact system;
- 5.2.3 indicator of **state of main automatic line voltage circuit breaker**;
- 5.2.4 indicator of charge/discharge of the batteries;
- 5.2.5 indicator of **body voltage or leakage current exceeding the limits specified in paragraph 4.2.**

B. JUSTIFICATION AND QUESTIONS

Para. 2.1.8: Allows theoretical possibility of Class A or B trolleybuses. Confirms application to dual mode and guided trolleybuses.

Annex 12:

General: Language and presentation improvements, and consistent use of terminology, suggested throughout.

2. Guided trolleybus applications may use a pantograph with current return through the guidance system whilst operating on the guideway in place of the conventional two-pole system. A vehicle may be equipped with both devices.

3.10.6 Present paragraphs 3.10.6 and 3.10.7 appear to overlap and have been merged as new para. 3.10.7.

3.11.1 Is it necessary to specify a direction for this vibration?

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