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agenda item 1)

**OICA PROPOSALS FOR AMENDMENTS TO ECE REGULATION N°36
WITH REGARD TO TROLLEY-BUS SAFETY (Annex 8)**

Reference document: TRANS/WP29/GRSG/2000/11

The following draft revised Annex 8 to ECE Regulation N°36 is proposed by OICA including relevant justifications:

Annex 8

SAFETY PROVISIONS FOR TROLLEY-BUSES

DEFINITIONS

For the purposes of this annex :

i. Contact system voltage

Trolley-buses can be supplied with contact system voltage of [nominal]] rated value of :

- 600 V (a working range of 400 to 720 V) [` 25%]
- 750 V (a working range of 500 to 900 V) [` 25%]

ii. Electrical circuits of trolley-bus

- high voltage circuits means circuits supplied with contact system voltage ;
- low voltage circuits means circuits supplied with accumulator battery voltage **and/or with a convertor outlet of nominal 24 V voltage ;**
- **[three phase circuits means circuits supplied with a second convertor outlet of three phase 400 V AC voltage] ;**

Justification : Existing nominal values to be checked however by electrical specialists. Three phase circuits would only be mentioned if needed by specific provisions in the present Annex.

iii. Rated climatic conditions

Trolley-buses are intended to provide reliable transit service in the environmental conditions with :

- a temperature range of minus 40°C to plus 40°C ;

- a relative humidity of 98 per cent at temperature of 25°C and lower ;
- an atmospheric pressure of **8,65 to 10,65 Pa** ;
- altitude from sea level 1000 m maximum

Justification : Pa is the atmospheric pressure standard unit.

1. POWER COLLECTION

1.1 Electrical power from overhead wires is transmitted to the trolley-bus by power collectors. A power collector comprises a pole, a trolley electric current collector and a replaceable collector insert. Power collectors are hinged to trolley bases, and turning in horizontal and vertical directions.

1.2 Poles shall be made of **plastic or metal covered with** insulating material resistant to metal shocks.

Justification : Metallic poles are an existing design. Maintenance is not a type approval item.

1.3 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 at trolley-bus **axis to axis** deviation distance of at least 4.0 metres to each side with respect to the overhead wires.

Justification : Only for clarification.

1.4 In case the pole dewires, trolley electric current collector(s) shall not be raised higher than **1 metre above the electric supply wires at their heights defined in paragraph 1.3.**

1.5 In case the pole dewires the power collectors shall be equipped with a device that automatically pulls down the pole to not less than 0.5 metres above the roof of the trolley-bus.

Justification : To be objective and less design restrictive. Maintenance is not a type approval item.

1.6 The trolley electric current collector, if wrenched out the pole, shall be kept connected to the pole and should not fall down.

1.7 Insulation resistance of the electric current collector to trolley bases shall be at least **[10 MW :]**
The figure is to be checked by electrical specialists.

1.8 Power collectors **may** be equipped with remote control from the driver's compartment at least for dewiring.

1.9 Certain arrangements at the trolley-bus shall provide an opportunity to replace, if necessary, **power collector** inserts in transit service conditions.

Justification : To be more flexible and not design restrictive.

2. TRACTION AND AUXILIARY EQUIPMENT

- 2.1 Electrical components installed on the trolley-bus shall be protected against overvoltage and short-circuit current. Protection shall be **assured by circuit breakers that are reset either automatically, remotely or manually.**
- 2.2 Electrical components shall be protected against commutator or atmospheric overvoltage.
- 2.3 Current-breaking apparatus shall provide interruption of particular damaged circuits.
- 2.4 For any circuit only protective apparatus shall interrupt the positive side of the circuit.
- 2.5 All electrical circuits and circuits branches shall be of dual wiring. Trolley-bus body **may** be used for current return grounds only for low voltage electrical circuits.
- ~~2.6 Control circuits, light signalling devices, lighting etc. shall be fed from DC low voltage source comprising of accumulator battery and charger.~~

Justification : This text is unnecessary : to be deleted.

- 2.7 [Case, cell covers and trays shall be made of unflammable or hardly flammable materials.] ISO standards should be referred to, not to be subjective.
- ~~2.8 Trolley bus should be as tolerant as possible to power system operational working range limited by national standard in country trolley bus delivered to.~~

This paragraph is to be deleted as contrary to uniform international provisions.

- 2.9 Electrical components energized by the trolley line voltage shall have additional insulation from the body and transmission.
- 2.10 Electrical components with exemption of traction resistors shall be protected against moisture and dust.
- 2.11 At rated climatic conditions the insulation resistance of electrical circuits when all rotating machines and apparatus are switched on shall not be less than, M Ω :
- body to high voltage electrical circuits 5
 - high voltage electrical circuits to low electrical circuits 5
 - [body to positive pole of low voltage electrical circuits] 1

To be checked by electrical specialists

- 2.12 Wiring, cabling and Apparatus

- ~~2.12.1 Wiring and cabling must be assumed for operation at ambient temperature range of minus 40°N to plus 40°N.~~

To be deleted as already covered under section 5.5.6 of this Regulation

2.12.2 Only polyline wires shall be used for high voltage circuits. All high voltage DC wiring shall have insulation rated for 3000 V DC or AC.

Justification : To be less design restrictive, e.g. aluminium may also be used.

2.12.3 Mounted wiring and cabling **shall not be stressed mechanically**.

Paragraphs 2.12.4 to 2.12.13 are deemed to be covered under section 5.5.6 of this Regulation. Furthermore, such provisions are generally relevant to current technical practice.

2.12.14 Test voltage U_{tes} for electrical equipment, wiring and cabling for high voltage circuits shall be :

$$U_{tes} = 2.5 U + 2000 V,$$

where U = rated voltage of the contact system

Test voltage for low voltage equipment : $U_{tes} = 750 V$.

The figures are to be checked by electrical specialists.

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

- sine wave form vibration of 0.5 – 55 Hz frequency and 10 m/s² maximum amplitude including resonance if produced ;
- discrete shocks of 30 m/s² peak shock acceleration lasting 2 – 20 millisecond in vertical direction.

3. ELECTRICAL SAFETY OF PASSENGERS AND SERVICE PERSONAL

3.1 **“At any operation conditions leakage current shall not be higher than 3 milliamperes [mA] at voltage of 600 V DC**

Voltage limits between chassis and the road surface during operation :

$U < 15 V$	no alarm
$15 V < U_{max} < 50 V$	alarm
$U > 50 V$	alarm and disconnection

Justification : The Netherlands proposal is deemed preferable.

3.2 A trolley-bus must be equipped with onboard indicator or another device for permanent monitoring of leakage current or protection of people at the appearance of leakage current. The installation of leakage current control device does not exclude periodical inspection high voltage equipment insulation in transit service conditions.

3.3 Stanchions at doorway shall be made of insulated material or plated with mechanically durable insulation. Insulation resistance shall at least be 1.0 M Ω on a contact square of 100 +/- 5 cm².

3.4 The first steps shall be made of insulated material or plated with mechanically durable insulation. Insulation resistance shall at least be 1.0 M Ω at a square of contact of 300 +/- 5 cm².

3.5 Door panels shall be made of insulated material or insulated from the trolley-bus body. Insulation resistance shall be 1.0 M Ω at least at a contact square on the panel of 300 +/- 5 cm².

3.6 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 trolley-bus body shall not be less than 1.0 M Ω at a square of contact of 200 +/- 5 cm².

3.7 **If the trolley-bus is equipped with a DC/DC converter, paragraph 3.3 to 3.6 shall not apply.**

Justification : This paragraph is to be added as such a converter would make insulation unnecessary.

4. THE DRIVER'S COMPARTMENT

4.1 In the driver's compartment there should not be high voltage equipment accessible to the driver.

4.2 **As a minimum**, the instrument panel shall consist of :

- gauge indicating existence of voltage in **the** contact system ;
 - indicator of **zero** voltage in **the** contact system ;
 - indicator of main automatic switch of contact system voltage state ;
 - indicator of charge/discharge of the batteries ;
 - indicator of dangerous potential on the body or leakage current exceeding permissible value.
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