

22 June 2015

Agreement

Concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions*

(Revision 2, including the amendments which entered into force on 16 October 1995)

Addendum 106 – Regulation No. 107

Revision 6 - Amendment 1

Supplement 1 to the 06 series of amendments – Date of entry into force: 15 June 2015

Uniform provisions concerning the approval of category M₂ or M₃ vehicles with regard to their general construction

This document is meant purely as documentation tool. The authentic and legal binding text is: ECE/TRANS/WP.29/2014/70 (as amended by paragraph 63 of the report ECE/TRANS/WP.29/1112).



UNITED NATIONS

* Former title of the Agreement: Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

Paragraph 2.41., amend to read:

"2.41. "Overnight locking system" means a system designed to provide the possibility to secure the service and emergency doors of the vehicle against opening."

Paragraph 10.9., amend to read:

"10.9. Notwithstanding paragraphs 10.7. and 10.8., Contracting Parties applying this Regulation shall continue to accept type approvals granted to the preceding series of amendments, which are not affected by the 05 series of amendments."

Add a new paragraph 10.10., to read:

"10.10. Contracting Parties applying this Regulation shall not refuse to grant extensions of approval for vehicles which are not affected by the 05 series of amendments."

Paragraphs 10.10. to 10.12. (former), renumber as paragraphs 10.11. to 10.13.

Annex 1, Part 1,

Appendices 1, 2 and 3, insert new items 6. to 6.6.2. to read (for Appendix 3, reserve items 4 and 5):

- "6. Special provisions for trolleybuses
- 6.1. Special environmental conditions for reliable operation:
 - 6.1.1. Temperature
 - 6.1.2. External humidity level
 - 6.1.3. Atmospheric pressure
 - 6.1.4. Altitude
- 6.2. Vehicle
 - 6.2.1. Dimensions with locked poles
 - 6.2.2. Supply
 - 6.2.3. Rated voltage of overhead line (V)
 - 6.2.4. Rated line current of vehicle (A) including auxiliary drives, HVAC
 - 6.2.5. Performance
 - 6.2.6. Maximum velocity (km/h: normal service/autonomous service)
 - 6.2.7. Maximum inclination (%: normal service/autonomous service)
 - 6.2.8. Description of main power circuits
 - 6.2.9. Circuit diagrams
 - 6.2.10. Protection measures (overview diagrams and drawings).....
 - 6.2.11. Insulation monitoring (if any)
 - 6.2.12. Make and type of monitoring device
 - 6.2.13. Principle of monitoring, description
 - 6.2.14. Description of insulation levels of components

6.3.	Electric motor
6.3.1.	Make and type of electric motor
6.3.2.	Type (winding, excitation)
6.3.3.	Maximum hourly/continuous power (kW)
6.3.4.	Rated voltage (V)
6.3.5.	Rated current (A)
6.3.6.	Nominal frequency (Hz)
6.3.7.	Location in the vehicle
6.4.	Power electronics
6.4.1.	Make and type of traction inverter
6.4.2.	Maximum continuous power
6.4.3.	Cooling system
6.4.4.	Make and type of 24V-battery charger
6.4.5.	Maximum continuous power
6.4.6.	Cooling system
6.4.7.	Make and type of 3-phase AC supply
6.4.8.	Maximum continuous power
6.4.9.	Cooling system
6.5.	Power supply for autonomous service:
6.5.1.	Storage system
6.5.2.	Battery/supercaps
6.5.3.	Make and type of storage system
6.5.4.	Weight (kg)
6.5.5.	Capacity (Ah)
6.5.6.	Location in the vehicle
6.5.7.	Make and type of control unit
6.5.8.	Make and type of charger
6.5.9.	Rated voltage (V) / minimum voltage (V), end of charge voltage (V)
6.5.10.	Rated current (A) / max. discharge current (A), max. charge current (A)
6.5.11.	Diagram of operation, control and safety
6.5.12.	Characteristics of charge periods
6.5.13.	Motor-generator unit
6.5.14.	Hourly/cont. power (kW)
6.5.15.	Make and type of unit or of motor and generator
6.5.16.	Fuel and fuel system

- 6.5.17. Location in the vehicle
- 6.6. Current collector
- 6.6.1. Make and type of current collector
- 6.6.2. Operation of current collector

Annex 1, Part 2,

Appendix 1, insert new items 1.12. to 1.12.1.4. to read:

- "1.12. Trolleybuses
- 1.12.1. Special environmental conditions for reliable operation:
- 1.12.1.1. Temperature
- 1.12.1.2. External humidity level
- 1.12.1.3. Atmospheric pressure
- 1.12.1.4. Altitude"

Appendix 2, insert new items 1.8. to 1.8.1.4. to read:

- "1.8. Trolleybuses
- 1.8.1. Special environmental conditions for reliable operation:
- 1.8.1.1. Temperature
- 1.8.1.2. External humidity level
- 1.8.1.3. Atmospheric pressure
- 1.8.1.4. Altitude"

Appendix 3, insert new items 1.4. to 1.4.1.4. to read:

- "1.4. Trolleybuses
- 1.4.1. Special environmental conditions for reliable operation:
- 1.4.1.1. Temperature
- 1.4.1.2. External humidity level
- 1.4.1.3. Atmospheric pressure
- 1.4.1.4. Altitude"

Annex 3,

Paragraph 7.3., amend to read:

- "7.3. Prevention of accidents
- 7.3.1. If the engine compartment of a vehicle is located to the rear of the driver's compartment, it shall not be possible to start the engine from the driver's position when the main engine access panel located in the rear face of the vehicle is open and which provide direct access to parts that represent a hazard when the engine is running (e.g. pulley of belt drives)."

Paragraphs 7.6.8.2. to 7.6.8.2.1., amend to read:

"7.6.8.2. Every emergency window shall either:

7.6.8.2.1. Be capable of being easily and instantaneously operated from inside and from outside the vehicle by means of a device recognised as satisfactory. This provision includes the possibility of using e.g. panes of laminated glass or plastic material, or"

Annex 8,

Paragraph 3.1., amend to read:

"3.1. Steps

The height of the first step ... of Classes II, III and B. In the case where only one service door meets this requirement there shall be no barrier or sign which prevents that door from being used as both an entrance and an exit.

As an alternative for vehicles of Classes I and A, the first step from the ground shall not exceed 270 mm in two door openings, one entrance and one exit.

In low floor vehicles only a kneeling system, but not a retractable step, may be engaged.

In other vehicles either a kneeling system and/or a retractable step may be engaged.

The height of steps in ..."

Annex 12,

Paragraphs 1.1. to 1.2.2., amend to read:

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

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

(a) 600 V (a working range of 400 to 720 V, and 800 V DC for 5 minutes); or

(b) 750 V (a working range of 500 to 900 V, and 1,000 V DC for 5 minutes); and

(c) Withstand over-voltages of 1,270 V for 20 ms."

1.2. The electrical circuits of a trolleybus are classified according to their rated voltage in the following classes:

1.2.1. "Voltage Class A" means a:

Rated voltage \leq 30 V AC; and

Rated voltage \leq 60 V DC."

1.2.2. "Voltage Class B" means a:

30 V AC $<$ rated voltage \leq 1,000 V AC; and

60 V DC $<$ rated voltage \leq 1,500 V DC.

Paragraph 1.2.3., shall be deleted.

Paragraphs 1.3. to 2.6., amend to read:

- "1.3. Rated climatic conditions
 - 1.3.1. Trolleybuses shall be designed to operate reliably under the following environmental conditions:
 - 1.3.1.1. A temperature range of minus 25 °C to plus 40 °C;
 - 1.3.1.2. A relative humidity of 98 per cent at temperatures up to 25 °C;
 - 1.3.1.3. An atmospheric pressure range from 86.6 kPa to 106.6 kPa;
 - 1.3.1.4. An altitude range from sea level to a maximum of 1,400 m above the sea level.
 - 1.3.2. Special environmental conditions, beyond the rated climatic conditions specified in paragraph 1.3.1. above, shall be indicated in the type-approval documentation (Annex 1, Part 1, Appendices 1 to 3) and communication form (Annex 1, Part 2, Appendices 1 to 3).
- 1.4. "*Self-extinguishing material*" means a material that does not continue to burn when the ignition source is removed.
- 1.5. "*Insulation*": there are different types of insulation:
 - 1.5.1. Functional insulation: ensures the functionality of the equipment;
 - 1.5.2. Basic insulation: protects persons from electrical hazards in systems with protective bonding;
 - 1.5.3. Supplementary insulation: protects persons from electrical hazards in systems without protective bonding;
 - 1.5.4. Double insulation: combination of basic and supplementary, each individually testable by a metallized intermediate layer.
- 1.6. "*Rated insulation voltage*"
 - 1.6.1. For circuits connected to the line voltage, the rated insulation voltage (U_{Nm}) for each part of the double insulation is the maximum line voltage according to paragraph 1.1. above; and
 - 1.6.2. For circuits insulated from the line voltage, the rated insulation voltage (U_{Nm}) is the maximum permanent voltage that occurs in the circuit.
- 2. Current collection
 - 2.1. Current shall be obtained from the contact wires by means of one or more connecting devices, normally comprising two current collectors. (A single current collector or a pantograph may be used in guided applications.) A current collector shall consist of a roof mounting (trolley base), a trolley pole, a current collector head and a replaceable contact surface insert. Current collectors shall be mounted so that they can turn in both horizontal and vertical directions.

A current collector shall achieve, as a minimum, a $\pm 55^\circ$ rotation about the vertical axis of its attachment to the trolleybus and a $\pm 20^\circ$ rotation about the horizontal axis of its attachment to the trolleybus.
 - 2.2. Trolley poles shall be made either of a material providing insulation or of metal covered with insulating material representing functional insulation to avoid short circuiting between the overhead lines in case of their detachment (de-wiring) and shall be resistant to mechanical shocks.

- 2.3. Current collectors shall be designed to maintain adequate positive contact with the contact wires when the wires are located at least between 4 and 6 metres above the ground and 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. Each trolley pole shall be equipped with a device that automatically retracts the pole in the event of the current collector becoming accidentally detached from the contact wire (de-wired).
- 2.5. In the event of de-wiring, contact between the retracted poles and any part of the roof shall be prevented.
- 2.6. The current collector head, if disconnected from its normal position on the trolley pole, shall remain attached to the trolley pole."

Paragraph 2.7., shall be deleted.

Paragraph 2.8. (former), renumber as paragraph 2.7. and amend to read:

- "2.7. Current collectors may be equipped with remote control from the driver's compartment, at least for retraction."

Paragraph 2.9. (former), renumber as paragraph 2.8.

Paragraph 3.5., amend to read:

- "3.5. All electrical circuits and circuit branches of voltage Class B shall be of dual wiring. The trolleybus body may be used as a conductor for protective bonding of circuits, double insulated from the line voltage, of voltage Class B. It also may be used as the return connection for voltage Class A circuits."

Paragraph 3.7., amend to read:

- "3.7. Electrical components connected to the line voltage shall have, in addition to their basic insulation, a supplementary insulation from the trolleybus body, the onboard power supply and signal interfaces.

For protection of current conducting parts and metallized intermediate layers inside the passenger compartment or luggage compartment, the protection degree IPXXD shall be provided (according to ISO 20653:2013).

For protection of current conducting parts and metallized intermediate layers in areas other than the passenger compartment or luggage compartment and not on the roof, the protection degree IPXXB shall be satisfied (according to ISO 20653:2013).

For protection of current conducting parts and metallized intermediate layers on the roof with protection by distance, no protection degree is required."

Insert new paragraphs 3.7.1. and 3.7.2., to read:

- "3.7.1. External insulations, e.g. on the roof and at the traction motor with occasional conductivity and regular cleaning, shall have a minimum clearance of 10 mm.

They shall be mounted with shelter from weather or be designed as umbrella insulators or insulators with drip edge or another method having equivalent effects. Silicon as material or covering is recommended. In this case, the minimum creep age distance shall be 20 mm.

With other materials or designs or mountings or extreme operation conditions, a greater creep age distance shall be chosen. Documentation of

the layout is part of the approval (see item 6.2.11. of Annex 1, Part 1, Appendices 1, 2 and 3).

- 3.7.2. Voltage class B equipment shall be marked with the lightning symbol. The symbol background shall be yellow, the bordering and the arrow shall be black.



The symbol shall also be visible on enclosures and barriers, which when removed, expose current conducting parts of voltage class B circuits. Accessibility and removability of barriers/enclosures should be considered when evaluating the requirement for the symbol."

Paragraphs 3.8. to 3.10.1., amend to read:

- "3.8. The current conducting parts of electrical components, with the exception of current collectors, surge arrestors and traction resistors, shall be protected against moisture and dust.
- 3.9. Means shall be provided for a periodic resistance test to be conducted on each basic and supplementary insulation of components with double insulation. With a new and dry trolleybus, the insulation resistance of electrical circuits at a test voltage of 1,000 V DC shall not be less than:
- 3.9.1. For each basic insulation: 10 M Ω ;
- 3.9.2. For each supplementary insulation: 10 M Ω ;
- 3.9.3. For the overall double insulation: 10 M Ω .
- 3.10. Wiring and apparatus
- 3.10.1. Flexible wires shall be used for all circuits. The rated insulation voltage of wires to ground shall be at least the rated insulation voltage according to paragraph 1.6."

Paragraphs 3.10.4. and 3.10.5., amend to read:

- "3.10.4. Wiring of different voltages classes shall be mounted separately.
- 3.10.5. Wiring conduits shall be made of non-flammable or self-extinguishing material. Conduits inside the passenger compartment of voltage Class B shall be closed and be made of metal. Metallic conduits shall be connected to the vehicle chassis."

Paragraph 3.10.12., amend to read:

- "3.10.12. Each of the insulations of voltage Class B equipment onboard the trolleybus shall be tested with an AC power supply at test frequency of 50 - 60 Hz for 1 minute.

The test voltage (U_{Test}) for wiring and components at the trolleybus shall be:

Basic insulation: $U_{Test} = 2 \times U_{Nm} + 1,500 \text{ V}$

Supplementary Insulation: $U_{Test} = 1.6 \times U_{Nm} + 500 \text{ V}$

For circuits double insulated from overhead line voltage, the test voltage (U_{Test}) shall be at least 1,500 V, or:

Basic Insulation: $U_{Test} = 2 \times U_{Nm} + 1,000 \text{ V}$

The equivalent DC test voltage is $\sqrt{2}$ times the AC value.

Reinforced insulation in trolleybuses is not allowed for circuits directly connected to overhead line."

Paragraphs 3.10.12.1. and 3.10.12.2., shall be deleted.

Paragraphs 3.11. to 3.11.2., shall be deleted.

Paragraphs 4.1. to 4.3., amend to read:

- "4.1. In a trolleybus, each circuit energized by an overhead line voltage shall have double insulation of the vehicle chassis.
- 4.2. The influence of dynamic charge currents, caused by capacitive couplings between voltage Class B equipment and electric chassis, shall be reduced by the protective impedance of insulating materials used in entrance areas. Stanchions and handrails at doorways, door panels and handles, mobility aid ramps and the first steps shall be made of insulating material, or covered with mechanical durable insulation or insulated from the trolleybus body.
- 4.3. The trolleybus shall be equipped with an onboard device for permanent monitoring of leakage current or voltage between the chassis and the road surface. The device shall automatically disconnect the high voltage circuits from the contact system (when trolleybus is stationary) if the leakage current exceeds 3 mA or if the leakage voltage exceeds 60 V DC (according to EN 50122-1 or IEC 62128-1)."

Paragraphs 4.4. to 4.7., shall be deleted.
