Amendment of R100 for 48V-Systems
6th EVS-gtr meeting
Seoul, November 2014
Amendment of R100 for 48V-Systems
design characteristic of 48V systems

Schematic Diagram

1. 48V (DC) < 60V (DC)  → OK
2. switched d.c voltage U <60V (DC ) → OK
3. AC phase to phase >30V, but safe on first failure → OK
4. System connected to electrical chassis

Electrical safety achieved without design of an isolated system.
Isolation resistance not testable in vehicle system.
**Amendment of R100 for 48V-Systems**

**ECE regulations: the updates for 48V system**

**ECE-R100 Rev. 2 – Amendment 1 (10\textsuperscript{th}, Jun., 2014)**

| 1 | ✓ "2.20. "High voltage bus" means the electrical circuit, including the coupling system for charging the REESS that operates on high voltage. Where electrical circuits, that are galvanically connected to each other, are galvanically connected to the electrical chassis and the maximum voltage between any live part and the electrical chassis or any exposed conductive part is \( \leq 30 \) V AC and \( \leq 60 \) V DC, only the components or parts of the electric circuit that operate on high voltage are classified as a high voltage bus. “ |

| 2 | ✓ "2.39. "Chassis connected to the electric circuit" means AC and DC electric circuits galvanically connected to the electrical chassis. “ |

| 3 | ✓ "5.1.3. Isolation resistance
This paragraph \textbf{shall not apply to chassis connected electrical circuits} where the maximum voltage between any live part and the electrical chassis or any exposed conductive part does not exceed 30V AC (rms) or 60 V DC." |

- **Limited the scope of “High voltage bus”**
- **Define “Chassis connected electrical circuit”**
- **Exempted from the requirement of “insulation resistance”**
48V-Systems: benefits, challenges, future tasks

Electrical safety analysis of 48V

A.C.: a.c voltages (switched/sinusoidal), a.c. current (sinusoidal)
⇒ in some operation modes U > 30V a.c. between phases,
⇒ but switched d.c. voltage U < 60V d.c. between phase and chassis

D.C. voltage, switched current (ripple)

D.C. voltage, d.c. current => U < 60V d.c.
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D.C. voltage switched
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Electrical safety analysis of 48V

Electrical safety of the 48 V system would be ensured by:

(a) avoiding the threshold for high voltage on DC circuit
(b) limiting the voltage between phase and chassis on the AC circuit
(c) physical protection provided by IP degree (enclosures, barriers...)
(d) insulation of wiring
(e) equipotential bonding

There is no risk of being exposed to high voltage in a single failure condition, in case of touching one phase (first failure), at least a second failure need to occur to touch the second phase.

Protection against direct contact is also provided by mechanically robust enclosures or insulation and two indirect contacts are avoided due to equipotential bonding
48V-Systems: benefits, challenges, future tasks

Electrical safety analysis of 48V

Direct contact

Safety ensured if first failure direct contact between one phase and chassis occurs. Direct contact between two AC phases is not possible on first failure.
48V-Systems: benefits, challenges, future tasks

Electrical safety analysis of 48V

Safety ensured if first failure indirect contact between exposed conductive part and chassis occurs.
Thank you for your attention