48 V System – Integration in GTR EVS

Input for OICA / GTR EVS-Meeting
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48 V System
Modified proposal for GTR EVS

- Motivation
- Current text from ECE R100
  - Proposed definitions and requirements
  - Issuess with current solution
- Objectives of modified proposal
- Modified proposal – new text

48 V System
Motivation

- Requirements for 48 V systems shall not be design restrictive
- Requirements for 48 V systems shall be limited to safety relevant issues

➔ To achieve this goal, a slight modification of the requirements from ECE R100 is proposed for GTR

48 V System – Current text from ECE R100 Definitions and requirements

ECE-R100 Rev. 2 – Amendment 1 (10th, Jun., 2014)

Chassis connected 48 V system

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 ≤ 30 V AC and ≤ 60 V DC, only the components or parts of the electric circuit that operate on high voltage are classified as a high voltage bus**."

→ 48 V DC exempted from scope of "High voltage bus"

2

"2.39. "***Chassis connected to the electric circuit***" **means AC and DC electric circuits *galvanically connected to the electrical chassis*.**"

→ Defines "Chassis connected electrical circuit"

3

"5.1.3. Isolation resistance
This paragraph **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 30 V AC (rms) or 60 V DC.**"

→ 48 V exempted from the requirement of "insulation resistance"

48 V System – Current text from ECE R100 Issues with current solution (1/4)

- The proposed text is based on two conditions
  - Electrical circuits, that are galvanically connected to each other, ***are galvanically connected to the electrical chassis***

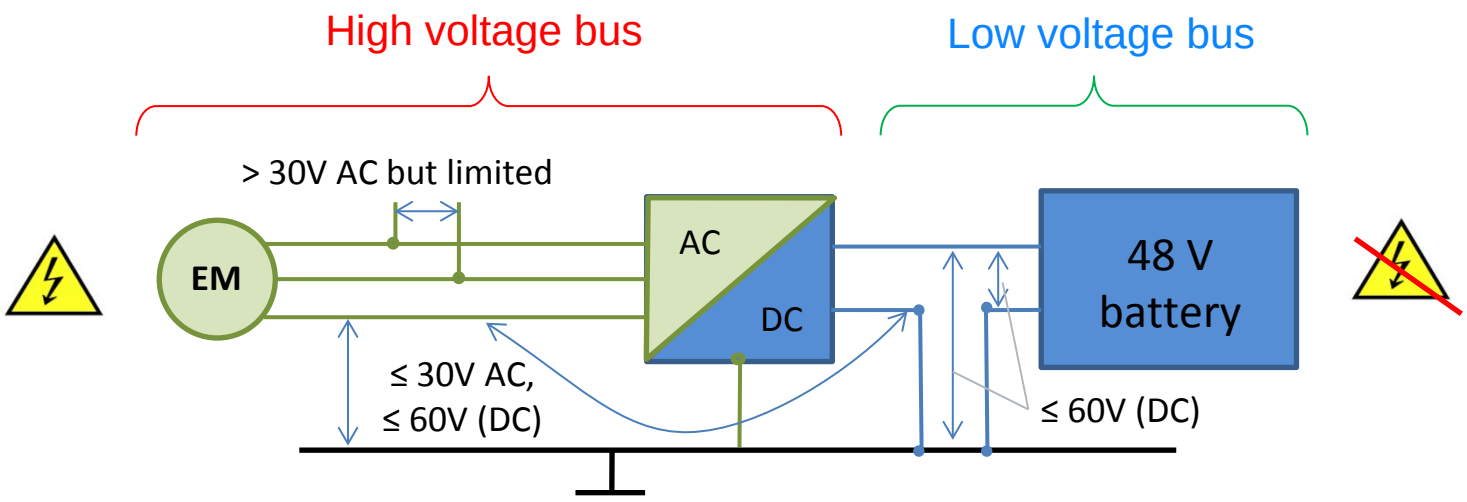
  AND

  - the maximum voltage between any live part and the electrical chassis or any exposed conductive part ***does not exceed 30 V AC (rms) or 60 V DC***

48 V System – Current text from ECE R100 Issues with current solution (2/4)

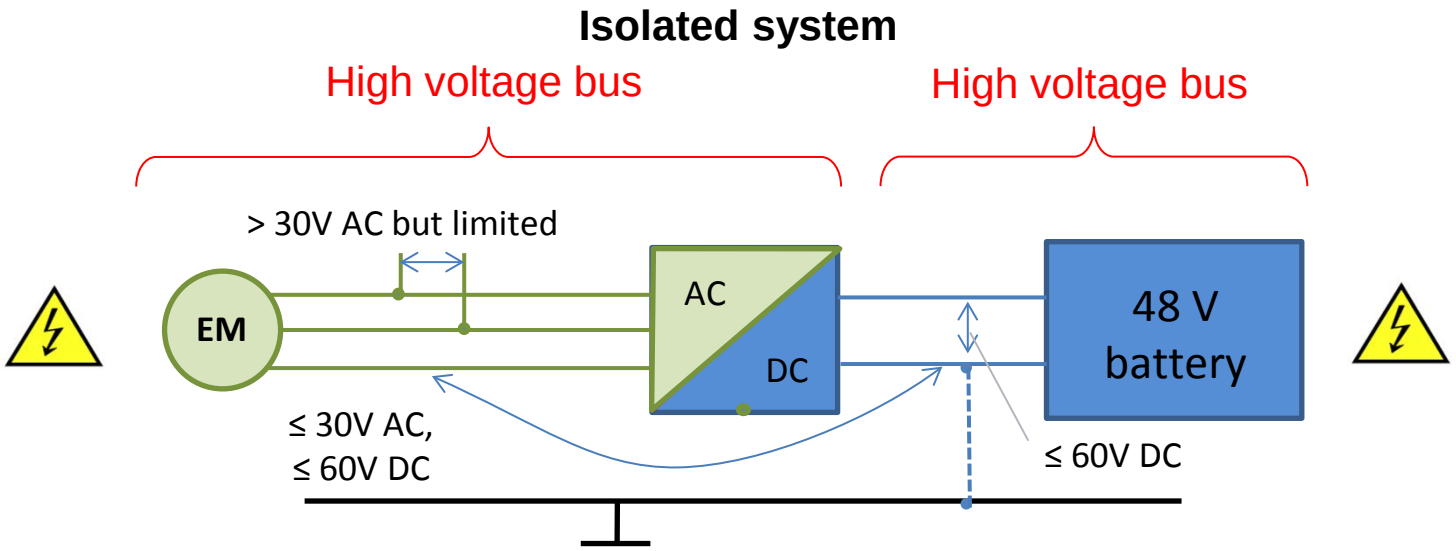
- The proposed text allows the following exemptions ***for chassis connected*** 48 V systems only (connected to chassis by design)
  - 48 V DC electrical circuit are exempted from scope
  - 48 V system are exempted from requirement of isolation resistance

Chassis connected system



48 V System – Current text from ECE R100 Issues with current solution (3/4)

- For ***isolated*** 48 V systems the whole system needs to fulfill all HV requirements **without any exemption**
  - This applies also when the voltage limits „*maximum voltage between any live part and the electrical chassis or any exposed conductive part does not exceed 30 V AC (rms) or 60 V DC*" are fulfilled, even if a connection of the isolated system to chassis is assumed.



48 V System – Current text from ECE R100
Issues with current solution - Summary (4/4)

ECE-R100 Rev. 2 – Amendment 1 (10th, Jun., 2014)

Issues

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 ≤ 30 V AC and ≤ 60 V DC, only the components or parts of the electric circuit that operate on high voltage are classified as a high voltage bus.**"

→ 48 V DC exempted from scope of "High voltage bus", ***but only for chassis connected system; isolated 48 V system not covered***

2

"2.39. "***Chassis connected to the electric circuit***" **means *AC and DC electric circuits galvanically connected to the electrical chassis*.**"

→ ***Could allow chassis connection for AC and DC; only appropriate for DC***

3

"5.1.3. Isolation resistance
This paragraph **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 30 V AC (rms) or 60 V DC.**"

→ exemption from the requirement of "isolation resistance" ***only appropriate when DC part is connected to chassis***

48 V System
Objectives of modified proposal

- Requirements should be not design restrictive as long as safety issues are not concerned
- Description of design independent safety requirements to allow
  - Chassis connected 48 V system as well as
  - Isolated 48 V system
- Requirements should be focused on safety relevant issues only
- For safety reasons it is sufficient to specify the following:
  - Specific voltage conditions for electrical circuits between a DC live part and any other live part (DC, AC)
- Clarification for marking requirement
  - Marking for REESS of < 60 V DC is required, when it is galvanically connected to an electrical circuit where the requirements for 48 V systems are violated

48 V System – Modified proposal
New text (1/4) – Definition „High voltage bus“

48 V system – chassis connected and/or isolated

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 *and fulfilling the specific voltage condition*, ~~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 ≤ 30 V AC and ≤ 60 V DC,~~ only the components or parts of the electric circuit that operate on high voltage are classified as a high voltage bus.**“

48 V DC exempted from scope of “High voltage bus”

2

~~"2.39. **"Chassis connected to the electric circuit" means AC and DC electric circuits galvanically connected to the electrical chassis.“.**~~”

Definition is misleading and not necessary

48 V System – Modified proposal
New text (2/4) – Def „Specific voltage condition“

3

“2.x ***“<u>Specific voltage condition</u>” means the condition that the maximum voltage of a galvanically connected electrical circuit between a DC live part and any other live part (DC or AC) is ≤ 30 V AC (rms) and ≤ 60 V DC.”***

Note: When a DC live part of such an electrical circuit is connected to chassis and the specific voltage condition applies, the maximum voltage between any live part and the electrical chassis is ≤ 30 V AC (rms) and ≤ 60 V DC.”

48 V system – chassis connected and/or isolated

Based on voltage between a DC live part and any other live part (DC, AC)

48 V System – Modified proposal
New text (3/4) – Isolation resistance

48 V system – chassis connected and/or isolated

4

"5.1.3. Isolation resistance

This paragraph shall not apply to *electrical circuits that are galvanically connected to each other, where the DC part of these circuits is connected to the electrical chassis and the specific voltage condition is fulfilled."*

48 V system with DC part connected to chassis is exempted from the requirement of “isolation resistance”

“Isolation resistance” is required for AC part of isolated 48 V system

48 V System – Modified proposal
New text (4/4) – Marking

48 V system – chassis connected and/or isolated

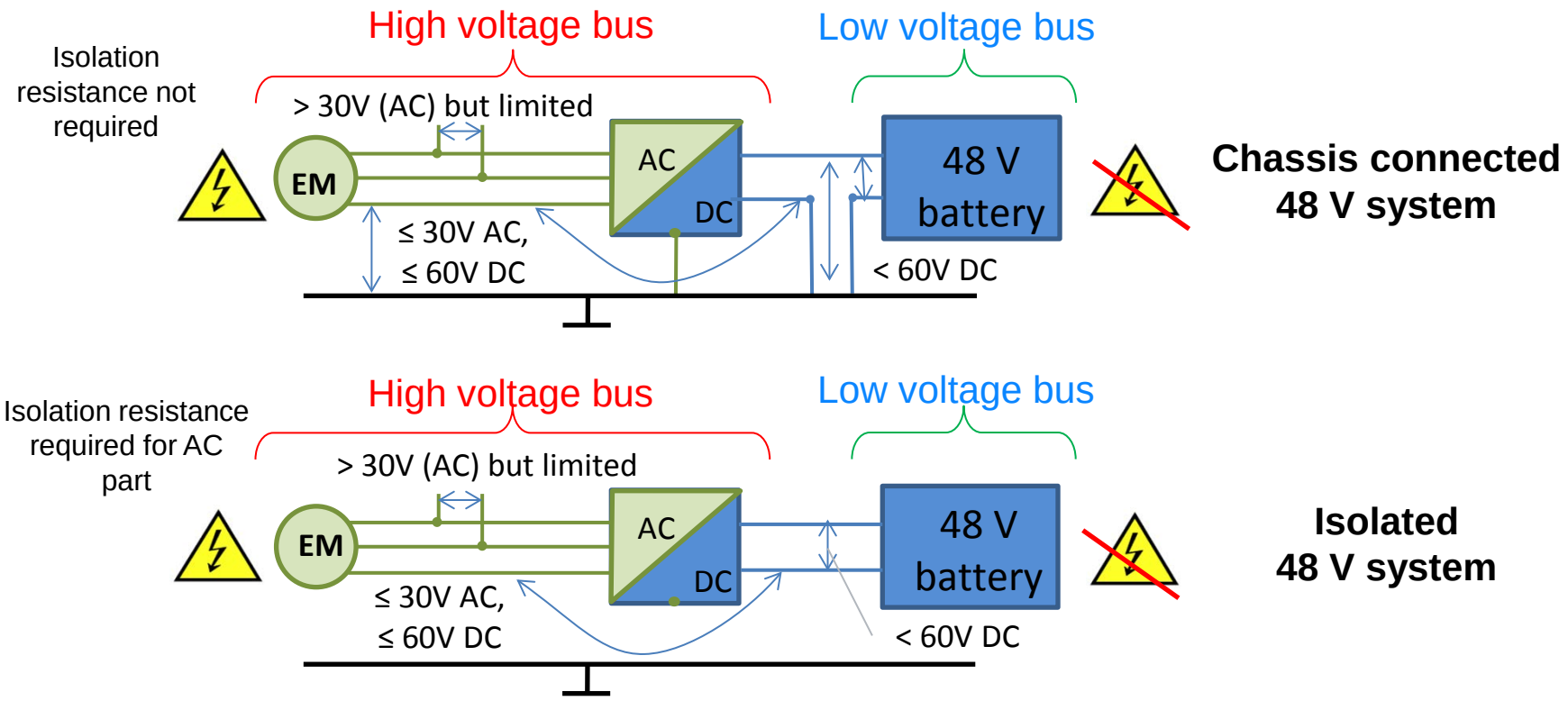
5

"5.1.1.5.1. In the case of a REESS having high voltage capability the symbol shown in Figure 1 shall appear on or near the REESS. The symbol background shall be yellow, the bordering and the arrow shall be black.
This requirement shall also apply to a REESS which is part of a galvanically connected electrical circuit where the specific voltage condition is not fulfilled, independent of the maximum voltage of the REESS.

Marking required for 48 V REESS that is connected to a circuit does not comply with the specific voltages conditions specified for 48 V systems

48 V System – Modified proposal
Consequences – DC part and isolation resistance

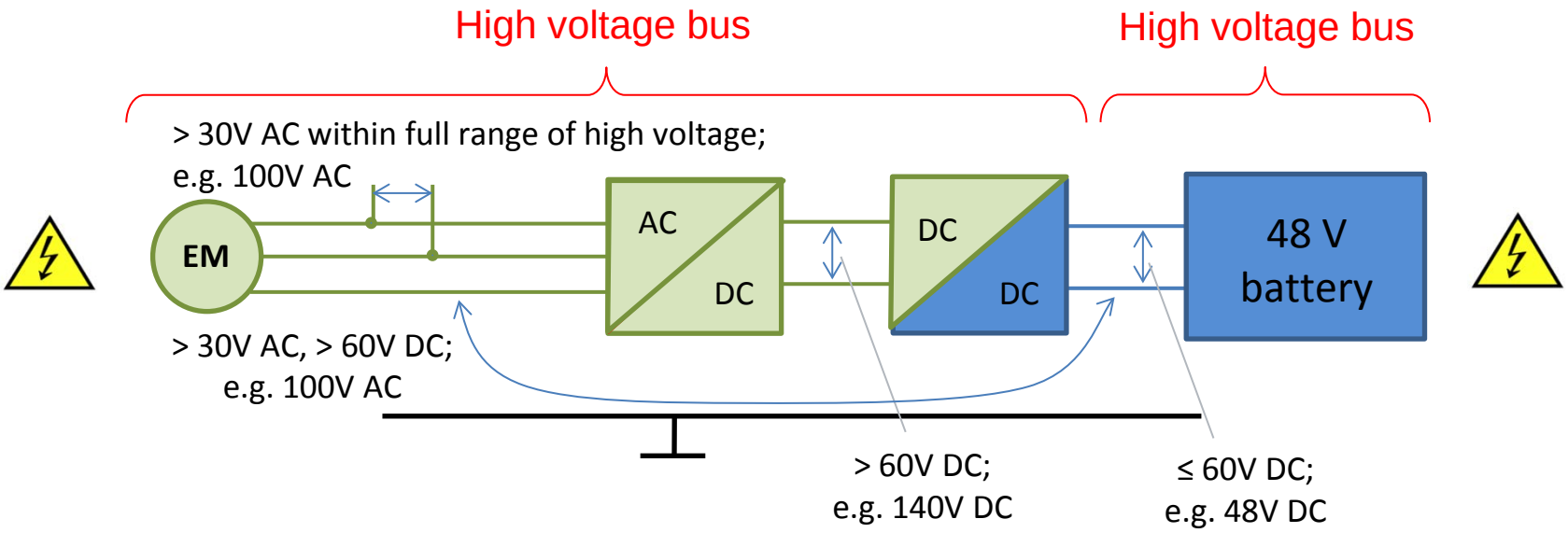
- Chassis connected and isolated 48 V systems are covered
  - 48 V DC electrical circuits are exempted from scope
  - 48 V system where the DC part is connected to chassis are exempted from requirement of isolation resistance



48 V System – Modified proposal
Consequences – Clarification for marking

- Systems where the requirement on specific voltage conditions (see „1“ and „3“) are not fulfilled, shall be treated as „high voltage electrical circuit“

High voltage electrical circuit –
Isolated system with REESS < 60 V DC



Voltages between live part and chassis are given for an assumed condition „connected to chassis“

48 V System – Modified proposal
Annex – Explanation for specific voltage condition

For 48 V systems only the use case according Position 3 is allowed. This is described in the definition of the „specific voltage condition“

	AC		DC	
Use case/ Position	Live part – chassis > 30 V	Live part – live part > 30 V	DC > 60 V	Comment
1	no	no	no	Not relevant, because not high voltage
2	no	no	yes	Not allowed
3	no	yes	no	allowed
4	no	yes	yes	Not allowed
5	yes	no	no	Not allowed
6	yes	no	yes	Not allowed
7	yes	yes	no	Not allowed
8	yes	yes	yes	Not allowed

0 not true

1 true