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“Electrostatic discharge” for vehicle and component type approvals

Position of international automotive associations on the necessity of ESD tests

The phenomenon of electrostatic discharge is generally known and present in everyday life, for example when a person builds up charge by walking on a carpet. Here, the type of shoes and the air humidity play a decisive role.

In the automotive industry, the moment considered is when a person enters the vehicle. At this moment, it is conceivable that a discharge could occur. While the person is sitting in the vehicle (Scope R10: driving mode), recharging is unlikely.

During development, ESD tests are part of the consideration of electromagnetic compatibility (EMC) and are common in all industries. In the automotive sector, component manufacturers and vehicle manufacturers have been pursuing the quality objective of protecting components from electrostatic discharge for many years. In particular, the service case is considered, where a component is unpacked, handled and installed in the vehicle by a technician. The probability of occurrence is very low, as vehicle assembly and maintenance commonly take place under controlled conditions. Pre-damage to fail at a later point in time is rather unlikely. In case of an ESD failure, the component would be fully damaged and not functional. This would then be detected sufficiently early, before the vehicle is handed over to the customer and would therefore not pose a risk to the driver or other road users. Assembly and maintenance are excluded from the scope of R10 (see below).

In order to conduct uniform and reproducible ESD tests on components and vehicles in the automotive sector, the ISO standard 10605 was firstly published back in 2001 (latest 3rd edition was published in 2023, with an amendment already in progress). It defines test procedures for components (contact and air discharge, packaging and handling tests, as well as tests in powered operation with direct and indirect discharge) and for vehicles. The discharge voltages mentioned are examples (only informative). The exact discharge points and failure criteria shall be specified in the respective test plan.

Regulatory requirements of ESD tests

The UNECE R10, 06 series of amendments contains an exclusion of ESD tests on vehicle level:

6.10.4. Electrostatic discharge

For vehicles fitted with tyres, the vehicle body/chassis can be considered to be an electrically isolated structure. Significant electrostatic forces in relation to the vehicle's external environment only occur at the moment of occupant entry into or exit from the vehicle. As the vehicle is stationary at these moments, no type approval test for electrostatic discharge is deemed necessary.

This exclusion is in line with the protection objective of the regulation, which is described in the scope of application:

1.3. It covers:

- (a) Requirements regarding the immunity to radiated and conducted disturbances for functions related to direct control of the vehicle, related to driver, passenger and other road users' protection, related to disturbances, which would cause confusion to the driver or other road users, related to vehicle data bus functionality, related to disturbances, which would affect vehicle statutory data;

In terms of immunity, UNECE R10 consistently focuses on "immunity related functions". These are primarily components that contribute to the safety and driving dynamics of the vehicle.

For the special cases of vehicle locking systems, immobilizers, and alarm systems, Regulation UN ECE R161, R162 and R163 were put into force. All three regulations require ESD tests, which can be verified either at vehicle level or at component level. In contrast to R10, these regulations only consider a single component. The focus here is on ensuring that an ESD discharge does not, for example, lead to the unexpected activation or deactivation of the vehicle lock/immobilizer/alarm system.

The requirement for ESD tests in regulations R161, R162 and R163 seems justified in order to protect the vehicle against unauthorized use with regard to its protective equipment. Acknowledging that their intended use case differs from the one of UN-R10, those regulations still cover the scenario of a typical first contact when a person that has built up charge suddenly discharges at a vehicle's door handle. A general requirement in R10 is not reasonable or necessary.

Reference to the proposal of the Dutch contracting party

(IWG-EMC-48-06e (NL) Draft Proposal to no longer exclude ESD from R10_08)

EMC experts of international industry organizations have reviewed the proposal and consider the following comments:

Both the interior and the exterior of a BEV, a PHEV or an ICE are virtually the same. In recent years, more and larger displays, more lighting, seat climate, massage, adjustment, etc. may have been added to the interior, but no HV or charging technology. This means that there is no new "immunity-related function" hardware that has been introduced in ESD-relevant areas in recent years (steering wheel, brakes, headlights, etc.), i.e. both the interference source (ISO 10605 - ESD pulses) and the interference sink (the points that can be touched by the occupants or are accessible from the outside) remain unchanged.

The exception (6.10.4 in UN R10 Rev. 06) is still fully valid meaning there is no technical justification for amending R10.

The scope of R10 already fully excludes the proposed cases of vehicle assembly and maintenance.

ESD is ensured from the start of development. This means that ESD vehicle tests are generally carried out significantly earlier than when the vehicle is type approved. Thus, that "R10 ESD tests" would represent a clear additional expense without any added value. According to E/ECE/Trans/505/Rev.3 and GRE-86-02 Rev.1, when expanding requirements, it shall be ensured there is added value that is also technically and economically justifiable.

According to the "Terms of Reference" (GRE-86-02 Rev.1) of the IWG EMC, the following points should be taken into account:

- II Objective / f.) "Adapt requirements to technical progress": As explained in the previous sections, there are no technical changes in ESD relevant areas of vehicles. Therefore, there is no reason to introduce ESD requirements due to new technologies in the R10.
- II Objective / I). Reduce unnecessary regulatory burden on the industry.": The IWG EMC should concentrate on the important topics for the further development of R10 (e.g. frequency range extension, bi-directional charging, reverberation chamber).

Conclusion

The international industry associations OICA/CLEPA/IMMA/CEMA do not support the implementation of ESD tests on component and vehicle level for type approval. ESD effects do not pose a risk to the driver or other road users. Adding ESD tests would increase the costs for testing and vehicle development unnecessarily. ESD tests are only a quality criterion and should not be implemented as a mandatory safety requirement.