BUGATTI RIMAC

Ms. Sophie Shulman

Deputy Administrator

National Highway Traffic Safety Administration

1200 New Jersey Avenue, S.E.

Washington, D.C. 20590

13th June 2024

Subject: **Notice of proposed rulemaking (NPRM) of the FMVSS 305a; Electric Powered Vehicles: Electric Powertrain Integrity**

[Docket No. NHTSA-2024-0012]

Dear Deputy Administrator Shulman,

Bugatti Rimac d.o.o. ("Bugatti Rimac" or the "Company") is pleased to submit comments to the National Highway Traffic Safety Administration ("NHTSA" or the "Agency") regarding Notice of proposed rulemaking (the "NPRM"), which seeks to introduce the new Federal Motor Vehicle Safety Standard ("FMVSS") 305a, "Electric Powered Vehicles: Electric Powertrain Integrity" to replace the existing FMVSS 305, "Electric-Powered Vehicles: Electrolyte Spillage and Electrical Shock Protection".

With the rapid increase in the number of electric-powered vehicles in the current fleet, it is crucial to address the safety concerns which those type of vehicles may pose. Therefore, Bugatti Rimac fully supports the Agency's proposal to extend the scope of requirements with aim to prevent and mitigate effects caused by hazardous events in crashes or faults in the Rechargeable Energy Storage Systems ("REESS") systems.

Bugatti Rimac would like to use this opportunity to identify certain considerations in the NPRM that the Company thinks need further assessment. By addressing them, Company believes the Agency will improve the effectiveness and practicality of this proposal, at the same time reducing the burden of the needed activities to prove compliance.

I. Comments

1) In addition to the vehicle-based tests, Bugatti Rimac proposes the inclusion of component-based tests on optional basis for evaluating vehicle controls that manage REESS safe operation

As a company with a portfolio including electric-powered vehicles, we are strong proponents of introducing performance requirements for vehicle controls responsible for managing the safe operation of REESS. These controls play a pivotal role in ensuring the reliability, efficiency, and safety of electric vehicles, particularly in managing the complex interactions within the REESS. By implementing performance requirements, we can bolster confidence among consumers and regulators regarding the safety and reliability of electric-powered vehicles. This proactive approach aligns with our commitment to innovation and advancing the adoption of electric mobility.

To assess vehicle controls that manage REESS safe operation, NHTSA is proposing only vehicle-based testing, because evaluating REESS safe operation at the vehicle level would include the entire vehicle system and the associated vehicle controls. The Agency's position is that conducting the tests at the component level would not assess all the relevant vehicle controls or any interaction or interference between vehicle controls.

Manufacturers certifying their vehicles according to the UN Regulation No. 100 have the flexibility to choose between vehicle or component-based testing, as permitted by the regulation. Should NHTSA fail to contemplate the inclusion of component-level testing, manufacturers pursuing component-based testing would encounter significant disruptions to their development plans. Incorporating the component-based testing would offer manufacturers greater flexibility and efficiency in their certification processes reducing timing and cost, without degrading the level of safety.

The Company believes that the vehicle-based tests, as explained in the NPRM, assess the real-world hazardous scenarios in a proper manner. However, given our objections above, we believe that Agency should, in addition to vehicle-based tests, incorporate component-based tests on optional basis, to follow the principle of UN Regulation No. 100.

2) Company seeks for interpretation of zero-volt measurements and advise the usage of megohmmeter for isolation resistance measurements

According to Section 7.2 of the NPRM (*"Test method for determining electrical isolation"*), all isolation resistance measurements require the usage of a voltmeter (with internal resistance of 10 MΩ) and the installation of an auxiliary known resistance R_o between the positive and/or negative side of the HV electric source and the vehicle chassis. The resistance R_o is installed in parallel to the isolation resistance R_i that is to be measured. The voltmeter is used to measure the voltage drop across resistance R_o, allowing R_i to be derived using standard formulas included in Figure 4 and Figure 5 of the NPRM. This approach is equivalent to those prescribed in both the current FMVSS 305 and UNECE Regulation No. 100, but with some differences.

i. With respect to the current FMVSS 305 test procedure in Section 12.10 ("*Electrical isolation baseline measurement*"), there is no indication provided in case the voltage drop measurement across R_o may result in a zero-volt measurement. This scenario would not allow the calculation of R_i through the formulas mentioned above (division by zero). In fault-free conditions, R_i can be multiple order of magnitude higher than commonly utilized R_o resistor, making the voltage drop across R_o too small to be detected through the voltmeter resolution.

ii. In contrast to UNECE Regulation No. 100 Annex 5B *("Isolation resistance measurement method for component-based tests of a REESS")*, the text of the NPRM does not allow the use of a megohmmeter installed between active parts and ground as an alternative method for measuring isolation resistance. Unlike the voltmeter method, measurement via a megohmmeter always allows for the derivation of a well-determined value for the isolation resistance R_i by imposing an external voltage source between the active pole and vehicle ground (up to the maximum working voltage of the HV source).

Therefore, Bugatti Rimac highlights the need for instructions on how to interpret a zero-voltage measurement across R_o and recommends the inclusion of the megohmmeter as a valid alternative for isolation resistance measurement. We believe this approach would provide a reliable means of determining R_i even when the voltage drop across R_o is too small to be measured accurately.

3) Agency should reconsider the REESS SoC range definitions

According to Section 12 of the NPRM (*"Performance tests for evaluating vehicle controls that manage REESS safe operation"*), some of the prescribed performance tests shall be initiated with vehicle REESS State of Charge ("SoC") in the following ranges: 90-95% (Section 12.1, 12.4, 12.5), 40-50% (Section 12.3.) and 10-15% (Section 12.2).

In Section 4, the following definition of SoC is provided:

"State of Charge (SOC) means the available electrical charge in a tested device expressed as a percentage of its rated capacity."

This definition is in accordance with definition provided in Paragraph 2 of UNECE Regulation No. 100 as well. The main difference between these lays in the fact that no absolute initial SoC values are prescribed in UNECE Regulation No. 100, but rather expressions like the ones listed below, which have a clear reference to manufacturer-specified normal operating range/conditions:

ANNEX 9H:

"The SoC of REESS shall be adjusted at the low level, but within normal operating range, by normal operation recommended by the manufacturer."

ANNEX 9G and 9J:

"The SoC of REESS shall be adjusted around the middle of normal operating range by normal operation recommended by the manufacturer."

ANNEX 9-Appendix 2:

"The REESS shall be charged to the highest SOC in accordance with the procedure specified by the manufacturer for normal operation."

Prescribing absolute values for SoC of the REESS, without consultation of manufacturer-specified SoC operational windows, may influence test results due to possible risk for the REESS to be out of its normal operating SoC range, even from the beginning of tests.

Since for each REESS the normal operation SoC window is defined by manufacturer according to product safety and performance, Bugatti Rimac proposes that <u>no absolute values of REESS SoC</u> would be initially prescribed, but a more similar approach to the UNECE Regulation No. 100 would be utilized.

4) Criterion to determine the start of thermal runaway is not clearly expressed

A criterion to define a successful thermal runaway initiation of at least one cell is not included in the Section 13.3, although the definition of thermal runaway in Section 4 is:

"Thermal runaway means an uncontrolled increase of cell temperature caused by exothermic reactions inside the cell."

In Section 23B.3.3 of GTR No. 20, there are three criterions to be used to define whether a cell experienced the thermal runaway. However, thermal runaway may be identified by visual check in case one or more cells catch fire, generate smoke and/or exhibit venting. Should NHTSA clearly state that GTR No. 20 23B.3.3. criterions are the ones applicable to FMVSS 305a, a cell instrumentation to detect thermal runaway would require the usage of pre-instrumented module/REESS due to the need to place temperature probe away from the heater as depicted in the GTR No. 20.

Given our remarks, Bugatti Rimac seeks for a clear definition of thermal runaway condition and confirmation whether instrumented cells will be allowed to recognize this event.

5) Company recognizes that external heater method for triggering thermal runaway might not be unanimously suitable method

The trigger method as proposed by the Agency in Section 13.3 (*"Test procedure for evaluating warning for thermal event in REESS"*) may not be suitable for applications with modules featuring totally enclosed cells in potting material or immersion cooling modules where the heating of the structure surrounding the target cell may be significant.

We would like to encourage the Agency to consider a solution that allows manufacturers to provide pre-instrumented modules/REESS, as explained in the GB 38031 standard. While external heating is the only trigger method for thermal runaway included in the NPRM, flexibility in the type of heater (e.g., TRIM, wound wire, induction heater) and heater parameters (e.g., power, temperature setpoint) is necessary to achieve a design-agnostic trigger process.

Should NHTSA not include other triggering methods, as an alternative, we would advise permission for manufacturers to define modifications to the module and to the REESS to accommodate an external heater.

6) Bugatti Rimac recommends extension of the lead period for small volume manufacturers

As proposed by the NPRM, the compliance date for the proposed requirements for large volume manufacturers ("LVM") is two years after the date of publication of the final rule in the Federal Register. Small volume manufacturers ("SVM") and final-stage manufacturers would be provided an additional year to comply with the rule beyond the date identified above. The Company identified that the proposed lead periods do not allow sufficient time for the necessary assessments and validation to be conducted properly for small volume manufacturers and including final-stage manufacturers.

In the past, regulations having significant impacts on the vehicle design solutions (e.g. FMVSS 111 and FMVSS 226) had longer phase-in periods, and the implementation dates for SVMs were at the end of these periods. This led to the result that SVMs should fulfil the new requirements starting from 4 to 6 years from the publication of the final rules.

With the new high impacting FMVSS 127, "*Automatic Emergency Braking Systems for Light Vehicles*", being published in May 2024, the following application dates were established: September 2029 for LVMs, and September 2030 for SVMs and final-stage manufacturers.

Given the impact level of both FMVSS 127 and FMVSS 305a and considering the lead periods of FMVSS 111 and FMVSS 226 in the past, Bugatti Rimac emphasizes it would be more sensible for small volume manufacturers to have a longer lead period so that multiple high impacting regulations start simultaneously. This is because small volume manufacturers usually have a limited portfolio of models in their fleet with longer lifetime. This does not easily allow SVMs to implement new architectural solutions without heavy impact on design and production.

For the reasons above, Bugatti Rimac proposes the extension of the phase-in period for SVMs so the application dates of FMVSS 305a will be aligned with those in FMVSS 127. By grouping application dates of high impacting regulations, the process will become more practical for small volume manufacturers and will mitigate the challenges associated with back-to-back application start of new regulations.

Conclusion

Bugatti Rimac supports NHTSA's effort to replace FMVSS No. 305 with a new FMVSS 305a and believes the proposed adoptions in the NPRM will protect against contact with HV sources during the daily operation of EVs (including charging), as well as in post-crash scenarios. The Company thanks NHTSA for providing this opportunity to share our comments regarding the implementation of this NPRM. Bugatti Rimac looks forward to work with the Agency further on this rule.

Should you have any questions, please contact at a.campochiaro@bugatti-rimac.com.

Sincerely,

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