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Ms. Sophie Shulman
Deputy Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue, S.E.
Washington, D.C. 20590

RE Docket No. NHTSA-2024-0012
Public Comments concerning Federal Motor Vehicle Safety Standard: No. 305a; Electric-Powered Vehicles: Electric Powertrain Integrity, Global Technical Regulation No. 20

Dear Ms. Shulman,

Eaton Corporation welcomes the opportunity to submit feedback concerning Federal Motor Vehicle Safety Standard: No. 305a; Electric-Powered Vehicles: Electric Powertrain Integrity, Global Technical Regulation No. 20. Eaton urges NHTSA to consider stronger overcurrent protection requirements and re-evaluate its decision not to impose a water submersion test for protection against water exposure.

Background

Eaton is an intelligent power management company dedicated to protecting the environment and improving the quality of life for people everywhere. We make products for the data center, utility, industrial, commercial, machine building, residential, aerospace and mobility markets. We are guided by our commitment to do business right, to operate sustainably and to help our customers manage power — today and well into the future. By capitalizing on the global growth trends of electrification and digitalization, we're accelerating the planet's transition to renewable energy sources, helping to solve the world's most urgent power management challenges, and building a more sustainable society for people today and generations to come.

Eaton was founded in 1911 and has been listed on the New York Stock Exchange for more than a century.

Eaton currently employs over 25,000 team members across the United States and operates facilities in more than 35 states, including over 70 manufacturing sites.

Eaton Principles and Position on the NPRM

Eaton is fully committed to supporting the energy transition towards a sustainable, carbon-neutral economy. One of the primary challenges impeding the widespread adoption of electric vehicles (EVs) is the prevalent safety concerns about EV batteries. Strengthened U.S. EV safety standards will help protect passengers and first responders, increase consumer confidence in EVs, and enable future adoption.

Eaton applauds NHTSA for its effort to update U.S. EV safety standards and encourages the U.S. to maintain safety standards that lead the world, reflect the latest technology, and ensure best in class protection. Advanced safety standards will ensure that the U.S. maintains a position of global technological leadership, and will ensure inexpensive and unsafe imports do not dilute EV car market in the U.S.

As NHTSA works to finalize this NPRM, Eaton strongly encourages NHTSA to:

1. Consider stronger overcurrent protection requirements.
2. Re-evaluate its decision not to impose a water submersion test for protection against water exposure.

Justification for Strengthened Overcurrent Protection Requirements

- Overcurrent conditions can commonly occur during a short circuit while charging, in a vehicle collision, or due to an insulation breakdown over time. In each of these scenarios, if the power cannot be shut off, the vehicle body can become “live” creating a shock hazard for occupants and first responders, and lead to increased risk of fire from overheating of contactors.
- Contactor failure is a frequent safety failure issue, as evidenced by recent vehicle recalls and can result in a permanently connected battery in the “on” state.¹
- **Recommendations:**
 1. To offer adequate protection to passengers and first responders, the battery should be isolated in the case of an overcurrent failure mode or a crash.
 2. In the case of an overcurrent event or crash, there should be protection against a single point of failure, which is standard practice (i.e., vehicle crash and contactor failure).
 3. Require manufacturers demonstrate they can fully isolate the positive and negative poles of the battery following a vehicle crash or overcurrent event.

Justification for Re-Evaluation of Proposed Protection Against Water Exposure Standards

- NHTSA’s proposal to adopt UN GTR 20’s washing test requirement in accordance with IPX5 meets the standards for normal driving conditions. However, NHTSA’s determination not to adopt any standards for submersion puts road users and first responders at risk.
- As NHTSA rightly points out, there are shortcomings to the China GB-38031 and Korean Motor Vehicle Safety Standard. However, NHTSA should work to develop a testing standard that is driven by data, based on science, and ensures a level of safety consistent with the state-of-the art.
- Requiring state-of-the-art testing standards would protect U.S. industry and enable manufacturers to develop their own solutions, while ensuring high safety standards are met.
- Rigorous test standards would enable the US to maintain a position of technological leadership and prevent lower-quality imports from entering the market.
- **Recommendations:**
 1. Eaton urges NHTSA to commit to a technical amendment. During this period NHTSA should meet with stakeholders, collect data, and adopt a testing requirement that would address submersion scenarios.

¹ [2021-2022 Ford Mustang Mach-E Recalled Over HVBJB Issue \(fordauthority.com\)](https://fordauthority.com/2021-2022-ford-mustang-mach-e-recalled-over-hvbjb-issue/)

2. Current battery pack leak check testing practices do not include testing of all sealing surfaces for water ingress and egress, allowing significant vulnerability in the battery. Specifically, the sealing surface between battery vent valves and the battery housing are often missed in current battery pack leak testing practices. There are at least two different leak check test methods available for assembled battery packs that check all sealing surfaces including the sealings between battery vent valves and the battery pack housing. Documentation requirements should include water ingress and water egress risk and require a leak check test for each battery pack at the end of the assembly line. The leak check must include all sealing surfaces of the battery pack.

Eaton position on the specific topics requested by NHTSA:

NHTSA Question	Eaton Position
<p>Mechanical Integrity Test Because there are no full vehicle crash tests currently in FMVSSs for heavy vehicles (other than heavy school buses), NHTSA seeks comment on a mechanical integrity test for REESS on heavy vehicles to evaluate post-crash safety at a component-level. As noted above, the current quasi-static loads of the integrity test specified in GTR No. 20 are specific to light vehicles. NHTSA seeks comment on the parameters for a possible quasi-static crush test for the REESS on heavy vehicles. The agency requests feedback on the merits of the integrity test in assessing post-crash safety for heavy vehicle REESS. NHTSA seeks comment on the practicability of such a test and on the specifics of subsystem components that should be included with the REESS while conducting the crush test.</p>	<p>Eaton supports the inclusion of the Mechanical Integrity test, but recommends adding acceptability criteria of:</p> <ol style="list-style-type: none"> 1. An isolation requirement from all parts of battery system to the external power output connectors of the battery pack 2. Avoid a single point of failure as a standard and best-practice.
<p>Mechanical Shock Test NHTSA seeks comment on the relevance of the mechanical shock test for heavy vehicles. NHTSA seeks comment on how the mechanical shock test would be performed on heavy vehicle REESSs, the appropriate accelerations levels that would be representative of acceleration levels observed in the field or in crash tests, and appropriate requirements which the REESS would need to meet in a mechanical shock test. NHTSA seeks comment on the best approach or test method for evaluating post-crash safety for electric vehicles with a GVWR greater than 4,536 kg (10,000 lb.). Specifically, NHTSA seeks comment and recommendations on other applicable safety tests and</p>	<p>Eaton supports the inclusion of the Mechanical Shock test, but recommends adding acceptability criteria of:</p> <ol style="list-style-type: none"> 1. An isolation requirement from all parts of battery system to the external power output connectors of the battery pack 2. Avoid a single point of failure as a standard and best-practice.

<p>corresponding objective performance criteria to evaluate the propulsion system crash safety performance of vehicles with a GVWR greater than 4,536 kg (10,000 lb.). NHTSA seeks comment on whether the moving contoured barrier crash test proposed for heavy school buses in the above section in this preamble can or should be applied to all heavy vehicles. (Page 26-31)</p>	
<p>Low Energy Option for Capacitors Based on the analysis results, NHTSA tentatively concludes that a post-crash electrical safety compliance option for capacitors based on an electrical energy of 0.2 Joules or less provides adequate safety from electrical shock and long-term harmful effects on the human body. Providing this post-crash compliance option would allow for practicable powertrain designs for battery electric and fuel cell vehicles without any reduction in safety. Automotive high-voltage systems typically utilize a number of capacitors connected to high voltage buses, and it is not always practical to discharge every capacitor post-crash. NHTSA tentatively believes that by providing this compliance option for a safe energy limit, vehicle manufacturers would have the flexibility to design products that assure safety. NHTSA seeks comments on the parameters (human body resistance, discharge profiles) used in the analysis and the analysis method. (Page 33)</p>	<p>Acceptability criteria above should be part of the low-energy option for capacitors. If the capacitors are discharged to below 0.2 Joules, it remains critical for the battery to be isolated to prevent re-charging.</p>
<p>Assessing Post-Crash Voltage Measurements For consistency with the GTR No. 20 test procedure, NHTSA proposes that the voltage measurements in FMVSS No. 305a would be made between 10 seconds and 60 seconds after the impact. The agency tentatively believes that 10 seconds after impact is sufficient time for voltage measurement and 60 seconds after impact is early enough that any high voltage arcing would be detected. NHTSA seeks comment on this approach. (Page 34)</p>	<p>The acceptability criteria noted above should be considered for the post-crash voltage measurements.</p>
<p>Electrolyte Spillage Versus Leakage NHTSA seeks comment on the inclusion of a post-crash electrolyte leakage requirement in FMVSS No. 305a and the necessity and</p>	<p>Eaton does not have a position.</p>

<p>relevance of such a requirement for current EVs. (Page 35)</p>	
<p>NHTSA Documentation Proposal NHTSA seeks comment on the documentation requirements described on pages 62-68.</p>	<p>Documentation requirements should include water ingress and water egress risk and require a leak check test for each battery pack at the end of the assembly line. Leak checks ought to include all sealing surfaces of the battery pack including the sealing between the battery vent valves and the battery pack housing</p>
<p>The IWG is continuing work on developing a test-based approach for SCTR due to an internal short-circuit in a single cell within the REESS. The plan is for a future regulation to require that the thermal propagation test procedure fulfill the following conditions: 1. Triggering of thermal runaway at a single-cell level must be repeatable, reproducible, and practicable, 2. Judgment of thermal runaway through common sensors, e.g., voltage and temperature, needs to be practical, repeatable, and reproducible, and 3. Judgment of whether consequent thermal events involve severe thermal propagation hazards, needs to be unequivocal and evidence based. NHTSA discusses this work in the Appendix B to this preamble. Comments are requested that could assist the agency in future decisions on this matter. (Page 70)</p>	<p>Eaton does not have a position.</p>
<p>Thermal Event Warning NHTSA seeks comment on the merits of the proposed performance test to evaluate the thermal event warning system instead of the documentation requirement in GTR No. 20. (Page 72) While this NPRM does not require specific features of the audio-visual warning itself, comments are requested on what characteristics an effective audio-visual warning should have. (Page 73)</p>	<p>Eaton does not have a position.</p>
<p>Vehicle Washing Test Comments are requested on the merits of including the test in FMVSS No. 305a. NHTSA seeks comment on the representativeness of the washing test, including but not limited to the proposed test conditions (e.g., 30-35 kPa versus 80-100 kPa water pressure conditions, water salinity levels, and water exposure durations, etc.). (Page 79-80)</p>	<p>Eaton supports the inclusion of this test.</p>

<p>Driving Through Standing Water Test NHTSA seeks comment on the maximum duration of this test. NHTSA also seeks comment on the availability and geometric dimensions of different types of wade pools (long rectangular, circular) to accomplish this type of test. (Pages 80-81) NHTSA seeks comment on the water salinity requirements for the physical tests as described above, including tolerances for the test parameters listed above. (Page 81)</p>	<p>Eaton supports the inclusion of this test.</p>
<p>NHTSA’s Consideration of Submersions The agency seeks comment on test conditions and test procedures that would address observed safety risks associated with submersion of REESS and high voltage components. (Page 81-84)</p>	<p>A submersion test is needed. GTR 20 and the Chinese test are insufficient. More data is required to establish a water submersion test that addresses real-world scenarios. Eaton recommends NHTSA meet with stakeholders, collect data, and design a test by establishing a technical amendment. Rigorous test standards would enable the US to maintain a position of technological leadership and prevent lower-quality imports from entering the market.</p>
<p>Miscellaneous GTR No. 20 Provisions Not Proposed Page 85-89 - description of the requirements and explanations of why NHTSA is proposing not to include the requirements. NHTSA requests comments on these views.</p> <ul style="list-style-type: none"> i. REESS Vibration Requirements ii. REESS Thermal Shock and Cycling iii. REESS Fire Resistance iv. Low State-of-Charge (SOC) Telltale 	<p>Eaton does not have a position on these provisions.</p>
<p>Request for Comment on Applying FMVSS No. 305a to Low-Speed Vehicles (Page 89)</p>	<p>Eaton does not have a position.</p>
<p>Rescue Sheets and ERGs NHTSA seeks comment on the proposed format and layout of rescue sheets and ERGs in accordance with the different parts of ISO-17840. (Page 94)</p> <p>NHTSA requests comments on whether electric vehicle ERGs and rescue sheets that were previously hosted on the NFPA website should be included in NHTSA’s centralized web location. (Page 96)</p>	<p>Eaton does not have a position.</p>
<p>VI. Request for Comment on Placing the Emergency Response Information and</p>	<p>Eaton does not have a position.</p>

<p>Documentation Requirements in a Regulation Rather than in FMVSS No. 305a (Page 96)</p>	
<p>APPENDIX B. Request for Comment on Phase 2 GTR No. 20 Approaches Under Consideration by the IWG (Page 124-131)</p> <ol style="list-style-type: none"> 1. Electrolyte Release and Venting From the REESS: NHTSA requests comment on the IWG’s continuing work on venting. Phase 2 of GTR No. 20 is considering more robust methods to verify the occurrence and quantification of electrolyte release and/or venting. 2. Single-Cell Thermal Runaway 3. REESS Vibration Requirements 	<p>Eaton recommends that Phase 2 of GTR 20 address the insufficient overcurrent protections and focus on establishing harmonized submersion testing standards and leak checks that address real-world flooding scenarios.</p>

Sincerely,



Christopher D. Hess
Vice President, Global Public Affairs