ALLIANCE
FOR AUTOMOTIVE
INNOVATION

June 14, 2024

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

RE: Federal Motor Vehicle Safety Standards; FMVSS No. 305a Electric-Powered Vehicles: Electric Powertrain Integrity Global Technical Regulation No. 20, Incorporation by Reference.

Dear Deputy Administrator Shulman,

The Alliance for Automotive Innovation (Auto Innovators) appreciates the opportunity to provide comments in response to the April 15, 2024, Federal Register Notice of Proposed Rulemaking (NPRM) on FMVSS 305a ("Electric-Powered Vehicles: Electric Powertrain Integrity Global Technical Regulation No. 20, Incorporation by Reference").[1,2]

Auto Innovators and its members support the goals of reducing vehicle greenhouse gas ("GHG") emissions, conserving energy, and a transition to electric vehicles ("EVs", including battery electric, plug-in hybrid electric, and non-plug-in hybrid electric vehicles, including fuel cell electric vehicles). In the years ahead, it is expected that, globally, automakers will invest $1.2 trillion toward vehicle electrification by 2030, including significant investments in U.S.-based EV and battery manufacturing.

Proactive efforts to address safety and build consumer trust are essential for achieving our shared goals as EV sales grow. As the new vehicle fleet transitions to include more electric options, manufacturers are not only investing in technologies that allow drivers to travel further and more efficiently, but they are also making significant advances in safety technologies to address potential (and perceived) safety concerns related to both normal operation and crash safety performance, as well as post-crash response. This includes improvements in vehicle crashworthiness to protect EV batteries during a collision, as well as proactive efforts to engage with first responders to improve the availability of emergency response guides when responding to a crash involving an EV.

In general, Auto Innovators supports NHTSA efforts to update the existing FMVSS 305 requirements to harmonize with global standards. We are also generally supportive of NHTSA efforts to include technical documentation requirements as part of the proposed rule. This provides a mechanism for manufacturers to demonstrate how various aspects of safety performance are being addressed throughout the vehicle development process and is a complement to the physical tests the agency has

[1] *From the manufacturers producing most vehicles sold in the U.S. to autonomous vehicle innovators to equipment suppliers, battery producers and semiconductor makers – Alliance for Automotive Innova on represents the full auto industry, a sector supporting 10 million American jobs and five percent of the economy. Active in Washington, D.C. and all 50 states, the association is committed to a cleaner, safer, and smarter personal transportation future. www.autosinnovate.org.*
[2] *89 FR 26704.*

proposed in the NPRM. Increased harmonization also allows for greater product standardization across multiple markets, which helps lower the overall cost to consumers. However, as outlined in more detail below, we recommend several improvements, including that the agency consider requiring the submission of relevant documentation through general regulation as opposed to including it as part of the FMVSS. This is in part due to the challenges in structuring any documentation requirements in wholly objective terms, as required by the Safety Act.

The safety of first responders is also of utmost importance as more EVs enter the marketplace. It is critical to increase education and awareness in the community so that any risks in responding to a crash can be effectively managed by those on the scene. Auto Innovators is strongly supportive of the proposed NHTSA requirements to standardize the format and submission of Emergency Response Guides (ERGs) consistent with international standards (ISO 17840). In addition to our recommendation that these ERGs be required through general regulation (as opposed to FMVSS), we also provide several recommendations for maximizing awareness among first responders about the availability of ERGs and improving access to information in emergency situations.

The automotive industry is also supportive of NHTSA's continued engagement on this issue. This includes involvement in international harmonization efforts to develop new standards and test procedures to evaluate various aspects of EV safety performance, as well as continued data collection initiatives to help identify whether future changes to the standard are needed. We look forward to future engagement with NHTSA on this important issue.

1. Comments on the FMVSS 305a Technical Requirements

Auto Innovators is generally supportive of many aspects of the NPRM, however there are several aspects of the NPRM where alternative approaches should be considered. These are outlined in more detail in the sections that follow.

a. Applicability and Scope of Rulemaking.

NHTSA requests comment on the applicability of the proposed rule and the extent to which it could be applied to evaluate safety performance for both heavy vehicles and school buses, with compliance options for both component- or vehicle-level testing based on manufacturer specifications.

The safety and integrity of EVs is a priority regardless of vehicle size. However, based on the research and supporting information provided in the NPRM, Auto Innovators opposes the inclusion of heavy vehicles in FMVSS 305a at this time. The potential design implications for heavy vehicles, which have not previously been subject to these regulatory requirements, require thorough consideration by the agency. More research is needed to justify the inclusion of heavy vehicles as part of the overall regulatory framework for evaluating overall safety performance of EVs. Extending the proposed requirements without such consideration will have an unknown impact on motor vehicle safety and could result in potential unintended consequences.

If the agency is to consider the inclusion of heavy vehicles, it must first conduct a comprehensive regulatory impact analysis, and issue a new rulemaking proposal as part of either a separate rulemaking notice or supplemental notice of proposed rulemaking (SNPRM). Additional research is also needed to understand whether alternative test procedures are needed to evaluate heavy vehicle performance and the potential impact these may have on motor vehicle design.

We are neutral on NHTSA including both school buses and low-speed vehicles within regulation.

b. Comments on the proposed NHTSA technical documentation requirements.

Auto Innovators agrees with NHTSA that there is currently no practical test procedure to evaluate the performance of vehicle controls in low temperature conditions, single cell thermal runaway and propagation due to an internal short-circuit, or providing a warning in the event of a malfunction in the vehicle controls that manage the safe operation of the Rechargeable Electrical Energy Storage System (REESS). For this reason, Auto Innovators supports NHTSA's proposal to require manufacturers to prepare technical documentation of how the vehicle addresses these risks and to provide that documentation to NHTSA upon request. However, Auto Innovators does not support the inclusion of these technical documentation requirements in the text of FMVSS 305a, but rather supports the alternative of placing these requirements in a general regulation. NHTSA specifically sought comment on this alternative.

Under the Vehicle Safety Act, a Federal Motor Vehicle Safety Standard is defined as a "minimum standard for motor vehicle or motor vehicle equipment performance." 49 U.S.C. § 30102(a)(10). FMVSSs must state the vehicle performance requirements in objective terms. 49 U.S.C. § 30111(a). A requirement to prepare technical documentation is not a standard for vehicle performance, nor does it state vehicle performance requirements in objective terms. In fact, NHTSA is considering technical documentation precisely because there are no objective performance criteria and test procedures that can be adopted to address vehicle battery performance at this time. For this reason, Auto Innovators submits that the technical documentation requirements are appropriately placed in a general NHTSA regulation, and not in FMVSS 305a.

NHTSA has the authority under 49 U.S.C. § 30117 to require manufacturers to provide technical information on safety and has the authority under 49 U.S.C. § 322 to adopt regulations implementing that authority. Auto Innovators agrees that the Vehicle Safety Act (49 U.S.C. § 30166(e)) authorizes NHTSA to require a manufacturer to make reports to enable NHTSA to decide whether the manufacturer has complied with a regulation issued under the Vehicle Safety Act, which in this case would be the technical documentation regulation. Taken together, this suite of authorities allows NHTSA to adopt a general regulation requiring manufacturers to prepare technical documentation about electric vehicle battery safety and provide that documentation to NHTSA upon request.

NHTSA correctly noted that the Vehicle Safety Act's recall notification and remedy provisions are not available for noncompliance with a general regulation, as they would be for a noncompliance with an FMVSS. Auto Innovators submits that the safety recall notification and remedy provisions are particularly unsuited to technical documentation requirements, for at least the following reasons:

- The safety recall provisions are in the law for the benefit of consumers and vehicle owners, to ensure that they are provided with free remedies to address FMVSS noncompliances or safety defects in their vehicles. The technical documentation proposed in this rulemaking would be provided to NHTSA, not vehicle owners. As a result, the statutory notification and remedy construct for safety recalls does fit the technical documentation requirement.

- The technical documentation for any given vehicle model will likely not be static, but rather will evolve over time as manufacturers gain experience with the systems and identify new risks, mitigation strategies, or both. The notification and remedy construct for safety recalls is unsuited to address dynamic, changing information in technical documentation.

- The Vehicle Safety Act provides that an FMVSS apply up to the point of first retail sale (49 U.S.C. § 30112(b)(1)). It is contemplated here that the technical documentation would change as needed after a vehicle is already in the market. This underscores why the notification and remedy provisions of the Vehicle Safety Act are not suited to technical documentation.

The technical documentation proposed by NHTSA would contain highly confidential information about EVs and about each manufacturer's risk assessment related to them. Auto Innovators recommends that NHTSA consider initiating rulemaking to add a Class Determination to 49 CFR Part 512 to deem the technical documentation submissions to be presumptively confidential and to exempt manufacturers from having to submit Part 512 justifications with each submission of technical documentation. Such a Class Determination would be an efficient way of addressing the confidentiality of these documents.

Auto Innovators also supports the agency's proposal to require the submission of standardized Emergency Responder Guides (ERGs), and to provide a mechanism whereby first responders can retrieve this information in an easily accessible way. Auto Innovators discusses this proposal in more detail below. However, for many of the same reasons cited above with respect to technical documentation, Auto Innovators here states its support for placing these ERG requirements into a general regulation, and not in FMVSS No. 305a. Unlike the technical documentation, however, the ERGs would be presumptively public information and available on NHTSA's website or other similarly accessible media.

c. Risk Mitigation for REESS

Auto Innovators requests that the agency provide additional compliance options that allow for component-level testing to evaluate the safety performance of the REESS as an alternative to vehicle-level testing. Requiring that all testing be conducted at the vehicle level is expected to add significant cost to manufacturers and, in some cases, introduce new safety challenges as part of the testing and evaluation process for both OEMs and NHTSA while conducting compliance verification. Furthermore, testing at the REESS component level would minimize test burden by enabling the test to be run once for vehicles with common REESS architectures. This approach is also consistent with UN ECE R100.03.

d. Heavy Vehicles -- Mechanical shock test.

Auto Innovators does not have significant concerns with the proposed mechanical shock test for heavy vehicles as the testing bands described in Table 1, 2, and 3 are clearly defined. However, there are certain aspects of the proposal that may need to be reconsidered, particularly where vehicle weight may be close to the weight thresholds used to specify applicable acceleration values that a vehicle may be subjected. For example, a 3,490 kg bus would test from 20-28g (Table 1), while a 3,510 kg bus would test from 10-17g (Table 2). Defining the required acceleration (g) load as a function of vehicle mass may provide a more granular method of stressing the REESS inversely proportional to the vehicle mass.

e. General Specifications related to crash testing.

Low energy option for capacitors. NHTSA tentatively concluded 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. Auto Innovators supports the agency's proposal to include this low energy requirement, which is consistent with GTR No. 20 and other applicable international regulations (e.g. ECE R100, GB 31498).

Assessing fires or explosion in vehicle post-crash testing. NHTSA proposed to include a requirement that there be no evidence of fire or explosion for one hour after the crash test for heavy school buses and for one hour after each crash test and subsequent quasi-static rollover test for light vehicles. Auto Innovators supports this proposal, which is consistent with GTR No. 20.

Assessing Post-Crash Voltage Measurements. NHTSA proposes that the voltage measurements in FMVSS No. 305a should be made between 10 seconds and 60 seconds after the impact. There may be practical limitations in the ability to collect post-crash isolation measurements manually within 60 seconds, especially given that isolation is a stable condition post-crash.[3] We request that NHTSA align with GTR No. 20 and specify that the isolation requirements be met after 10 seconds after impact without an upper bound on the time limit. Additionally, the vehicle level isolation calculations are not aligned between ECE 100.03 and FMVSS 305a.[4] It appears that the NPRM assumes that V1+V2=Vbat, but this may not be strictly true since the Digital Multi-Meter (DMM) used in testing can influence the voltage measurement by adding the internal resistance in parallel. To account for any potential discrepancies or practical limitations, we request the agency also provide a compliance option consistent with ECE 100.03 and FMVSS 305a.

Electrolyte Spillage Versus Leakage. Including an electrolyte leakage requirement is of questionable relevance because leakage outside of the pack enclosure should not be an issue for lithium-ion batteries. Based on field data, we are not aware of any reported incidents of harm. Further, there is no reliable or standardized method for detecting or quantifying whether leakage has occurred. To not meet the "5-liter maximum" requirement, extensive damage to the cells would need to occur and leak all free electrolytes outside of the enclosure. We recommend that this requirement be removed.

f. REESS Requirements Applicable to All Vehicles

General (venting). NHTSA proposes to include a provision in FMVSS No. 305a to limit safety risks to vehicle occupants due to venting during normal vehicle operations. The agency also proposes to use a similar approach to evaluate safety risks to vehicle occupants resulting from venting from the REESS. Auto Innovators disagrees with this proposal. The specific tests proposed are unlikely to result in venting, which renders any test procedures for evaluating this aspect of REESS unnecessary. In addition, visual inspection without disassembly is not expected to identify any venting, even if some de minimis amount were to occur. In regard to future research as part of Phase 2 of the IWG efforts on GTR No. 20, we recommend further study to identify the problem that needs to be addressed. This includes consideration for potentially classifying the type of gases that may need to be considered and determining the concentration of allowable gas that can be produced in instances where venting occurs.

Vehicle Controls for Safe REESS Operation. The NPRM proposes several performance requirements to establish controls for managing safe REESS operations. The agency also proposes to conduct full vehicle-level tests using a breakout harness connected to a battery tester/cycler to evaluate vehicle controls for safe REESS operation, rather than conducting the tests on the REESS as a separate component.

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[3] *Proposed post-crash isolation requirements include measurements from V1 to chassis, V2 to chassis, V1' to chassis (with a resistor in parallel) and V2' to Chassis (with a resistor in parallel).*
[4] *ECE 100.03*

- ***Overcharge protection.*** NHTSA tentatively concluded that the GTR No. 20 overcharge test is practical and feasible (*based on the agency's own testing*) and proposes to include the overcharge protection requirement and test procedure in FMVSS No. 305a. While we generally support the agency's proposal, we request that the agency also provide a compliance option for evaluating performance at the battery pack component level. Requiring this test at the vehicle level is expected to add significant cost to the manufacturers without any gains in robustness or stringency of the testing. In addition, testing at the REESS component level would minimize test burdens for manufactures by enabling the test to be run once for vehicles with common REESS architectures and BMS and would be consistent with the language used in ECE R100.03 & GTR No. 20. We also request that the agency allow for state of charge (SOC) adjustment to align with ECE 100.03 "around the middle of the normal operating voltage."[5] The proposed SOC range of 90 to 95 percent is excessively high and may cause systems to already be in overcharge protection mode, thereby inadequately testing the activation of protection. For consistency, the agency should allow for similar SOC adjustments when evaluating the safety performance of battery electric vehicles (BEVs), hybrid electric vehicles (HEVs), and plug-in hybrid electric vehicles (PHEVs).

- ***Over-Discharge Protection.*** NHTSA proposes to include the over-discharge protection requirement and test procedure in FMVSS No. 305a. Consistent with our comments on overcharge protection, we request that NHTSA also provide a compliance option for evaluating performance at the battery pack component level consistent with GTR No. 20, with vehicle controls in place for controlling the REESS function. We also request that the agency allow for SOC adjustment to align with GTR 20. The proposed SOC range of 10 to 15 percent is excessively low and systems may already be in over-discharge protection mode, thereby inadequately testing the activation of protection.

- ***Overcurrent Protection.*** NHTSA tentatively concluded that GTR No. 20's overcurrent test is practical and feasible (based on the agency's own testing) and proposes to apply the overcurrent test to vehicles that have capability of charging by DC external electricity supply. Auto Innovators supports this general approach. However, we request that NHTSA also include a compliance option that allows the test to be performed in a laboratory setting at the battery pack component level, with vehicle controls in place for controlling the REESS function.

- ***Over-Temperature Protection.*** NHTSA tentatively concluded that GTR No. 20's over-temperature test is practical and feasible (based on the agency's own testing) and proposed to include the over-temperature protection requirement and test procedure in FMVSS No. 305a. Auto Innovators supports this general approach, which aligns with GTR No. 20, but recommends that the agency consider increased alignment and provide an additional compliance option for evaluating performance at the battery pack component-level, with vehicle controls in place for controlling the REESS function. Prescribing that the test be conducted on a chassis dynamometer and/or in the "active driving possible mode" is overly prescriptive and unnecessary. We also request that the agency harmonize with aspects of ECE 100.3 to allow for the use of a temperature chamber to raise the ambient temperature closer to mimic over-temperature conditions.

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[5] *GTR20 6.2.6.3.1(b) "The SOC of REESS shall be adjusted around the middle of normal operating range by normal operation recommended by the manufacturer such as driving the vehicle or using an external charger. The accurate adjustment is not required as long as the normal operation of the REESS is enabled…"*

In addition, to reduce the test time and test burden, the agency does not believe it needs to specify presoaking of the vehicle. Auto Innovators agrees that presoaking should not be required, but it should be permitted. For component-level testing with an integrated controller, allowing control of ambient temperatures allows for the test to be conducted faster as desired temperatures can be achieved more easily. Additionally, specifying an upper limit of 30 °C for ambient temperature and a one-hour duration for temperature rise is unnecessary, as the test's objective is to raise the REESS to its upper safety temperature. If soaking of the RESS of the vehicle is allowed in a climatic chamber, the temperature should be specified by the manufacturer as the highest temperature allowed by RESS function controls. Such an approach would increase the practicability and speed of testing.

We also request that the agency allow for SOC adjustment to align with GTR 20. The proposed SOC range of 90 to 95 percent is excessively high and overcharge protection may be activated, which would interfere with the assessment of over-temperature protection.

- ***External Short-Circuit Protection.*** NHTSA tentatively concluded that the GTR No. 20 external short-circuit test is practical and feasible (based on the agency's own testing) and proposes to include the GTR No. 20 external short-circuit protection requirement and test procedure in FMVSS No. 305a. In general, Auto Innovators is supportive of the agency's proposal. However, as stated previously, testing should be permitted using either a complete vehicle with the complete REESS or with the REESS subsystem at the battery pack component level, with vehicle controls in place for controlling the REESS function. In addition, the agency should ensure requirements are harmonized with the SOC requirements in GTR No. 20[6]

- ***Low-Temperature Protection.*** As noted in the NPRM, since the effects of repeated charging at very low temperatures occur over a very long period of time, no practical test procedure is available to evaluate the performance of vehicle controls in low temperature conditions. NHTSA therefore proposes to include documentation requirements based on GTR No. 20 in FMVSS No. 305a. As noted previously, Auto Innovators supports the agency's proposal to establish technical documentation requirements, but opposes including them in FMVSS. Due to limitations of the Safety Act, as discussed in more detail in section 1.b above, they would be more suitably placed in general agency regulation of these comments. If a robust test procedure to evaluate the performance of vehicle controls in low temperature conditions is developed in future, we would welcome the opportunity to provide comment on the potential inclusion of this test as an alternative to the agency's proposal.

g. Mitigating Risk of Thermal Propagation Due to Internal Short Within a Single Cell in the REESS

Safety Need. With respect to the overall safety need, it is unclear whether this single cell thermal runaway requirement provide substantial additive safety benefits given the other requirements included in the proposed rule (i.e., robust thermal runaway and thermal propagation and detection systems with warning). We request that the agency provide additional research to support the inclusion of this requirement.

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[6] *GTR 20 6.2.1.2 specifies that for external charge, the SOC should be fully charged according to charge management control. For non-external charge, SOC should be maximum according to vehicle charge management.*

<u>Technical Documentation (*Thermal Propagation*).</u> NHTSA requests comments on whether the proposed technical documentation requirement would be better placed in a general agency regulation rather than in proposed FMVSS No. 305a. As discussed previously, Auto Innovators is generally supportive of the NHTSA proposal to establish technical documentation requirements consistent with GTR No. 20, ISO-6469-1: Amendment 1 2022-11, and ISO 26262. However, as discussed in more detail in section 1.b of these comments, are opposed to including these requirements in FMVSS, and suggest they instead be included in general regulation. We also request that the agency provide additional clarification on what is meant by the term "usual parking mode" as referenced in the NPRM.[7]

<u>GTR No. 20 Phase 1 Requirements.</u> In GTR No. 20, the scope of Part I requirements is limited to REESS with flammable electrolyte for the thermal propagation requirement. NHTSA must account for differences in battery chemistry because different battery chemistries create differences in the potential for thermal runaway to occur. This in turn creates different safety needs. For Ni-MH batteries, there are material technical that make it much less likely for thermal runaway. Absent field data showing any safety need relating to thermal runaway in these Ni-MH batteries beyond conventional vehicles, there is no need to include these batteries in the requirement.

There are also important technical differences between Ni-MH and Li-ion batteries. Internal short circuits are significantly less likely to occur in Ni-MH batteries because the separation between the positive and negative electrodes is approximately 10x larger in Ni-MH batteries [thickness of separator in Li-ion: ~20µm, Ni-MH: ~200µm]. This increased distance means that the resistance between the two electrodes is significantly higher, and a significantly larger foreign object is required to bridge the electrodes to create a short circuit. Further, the electrolyte generally used in Ni-MH batteries is not flammable (unlike with Li-ion batteries). Flammability of electrolyte is one of the essential causes for thermal runaway and its propagation. Non-flammable electrolyte used in Ni-MH does not cause exothermic reaction. Specifically, flammable liquid has a flash point of no more than 60°C. For these technical reasons, thermal propagation requirements in many existing voluntary and international standards, such as GTR No. 20, GB38031, and ISO6469-1, do not apply to Ni-MH. Forced internal short circuit testing does not apply to Ni-MH in IEC61982-4. Therefore, our recommendation is that NHTSA amend the requirements in S13 to exclude Ni-MH batteries.

- **Part I** ("*System analysis*")
  - The proposal to describe "which conditions specific to the vehicle could lead to a SCTR event caused by a short-circuit" is not clearly defined in comparison to what is required for TR and TP documentation in GTR No. 20. Additional specification or guidance may be needed to ensure compliance is met. The agency should also ensure processes are in place to allow subsequent updates or corrections to documentation to be made after the original submission.
- **Part II** ("*Safety Risk Assessment and Mitigation Process*")
  - Additional specificity should be provided to clarify the risks the agency anticipates being included as part of the required documentation.
  - With respect to primary risk mitigation strategies, we anticipate that this will require additional information from battery suppliers that may add burden beyond what the agency has estimated in this rulemaking.

[7] https://www.federalregister.gov/d/2024-07646/p-355

- On secondary risk mitigation strategies, the regulatory text in S13.2 specifies that secondary risk mitigation strategies specify that only a warning to a driver is required. However, the preamble suggests that warning systems to vehicle occupants/bystanders and/or notification to emergency personnel in the event of thermal propagation (e.g., automatic notification to 911 operators) are included. While manufacturers may choose to implement such strategies as part of any secondary risk mitigation strategies, it is not reasonable to suggest that these be required as part of FMVSS No. 305. However, the rule should not inadvertently limit a manufacturer from implementing such strategies as part of the secondary risk mitigation strategy response.

- **Part III** (“*Verification and Validation of Effective Risk Mitigation Strategies*”)
  - Auto Innovators is supportive of technical documentation, but additional clarification is needed to further understand the type of information that the agency will require beyond the requirements outlined in GTR No. 20. For example, are there specific parameters for what the agency might consider a valid validation strategy? At present, the requirement is not clear.

- **Part IV** (“*Overall Evaluation of Risk Mitigation*”)
  - As written, a manufacturer could not conduct such a review. We request NHTSA to clarify these requirements and add more detail.

Any future physical testing for SCTR should be repeatable, reproducible, and practicable. It is also important that the initiation method be relevant and/or representative of real-world conditions. It is our understanding that most SCTR in the field are not initiated by overheating (*which will tend to have an effect on several cells pre-TR and thus change the response*), nor by cell piercing (*which generally involve a large internal cell short and an unrepresentative opening in the REESS enclosure*). More common initiation for TR appears to be related to manufacturing defects within a single cell or aging / degradation mechanisms leading to SCTR within a single cell. We recommend additional study to evaluate a practicable method to reproduce these types of SCTR that do not produce unrepresentative responses due to testing limitations.

Warning Requirements. Auto Innovators generally agrees with the agency’s analysis and decision to not require a warning to occupants or documentation pertaining to a warning, and instead focus the regulation on the implementation of risk mitigation strategies to mitigate or prevent the occurrence of SCTR incidents due to limitations in the effectiveness of available test methods. However, we encourage further research on this topic and request that NHTSA regulations not prohibit the use of SCTR warnings if a manufacture chooses to implement these types of countermeasures.

h. Warning Requirements for REESS Operations

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. In general, we are supportive of the inclusion of a test procedure to evaluate thermal event warnings as a complement to the proposed technical documentation requirements, however, we have a number of substantive concerns with the agency’s proposal and recommend that the agency harmonize with the technical documentation requirements of UN R100.03, as discussed in more detail below.

As the agency is aware, since the instrumentation of a highly integrated REESS may influence the test outcome (and therefore not be representative of real world conditions) there are significant challenges in developing a robust test procedure for evaluating thermal event warnings that meets the objectives of the Safety Act. Furthermore, the test conditions proposed in the NPRM are not listed in the international standard, and the agency has not provided references to support the basis for the test procedure. As a result, it is not possible to properly evaluate the extent to which this proposal is objective, repeatable, or reproducible. We recommend that the proposed test procedure be excluded from FMVSS 305a.

We also have concerns with the proposed test method of using a heater that abruptly achieves 600ºC within 30 seconds to initiate thermal runaway in one or more cells. Due to requirements that resemble a full-scale vehicle-level thermal propagation test, this could result in unstable test conditions. We strongly oppose this as a potential outcome and contend that this should be further justification for harmonizing with the technical documentation-based requirements of UN R100.03. Consistent with prior comments, these should be placed in general regulation, not an FMVSS.[8] We also recommend extending the time beyond 30 seconds for the heater to reach 600°C. This would facilitate a more stable initiation of thermal runaway, allowing for an accurate assessment of the thermal event warning without introducing uncontrollable test conditions. Another potential alternative could be a component based REESS-only test, with either software verification or simulation of the warning, as opposed to a vehicle level demonstration.

Additional clarity and justification should be provided if the agency decides to implement requirements other than the recommended UN R100.03 technical documentation approach. The current proposal does not include sufficient information to justify the proposed requirements or minimize potential test variability. For example, regarding the heater, it is unclear how the agency decided upon the three-minute timeframe, as this time duration could also, in some cases, allow for fire to propagate in an uncontrolled way. In S13.2 of the proposed regulatory text, NHTSA states that a warning is required within three minutes of activating the heater, but this does not take into account the time from when the heater is activated until a thermal incident occurs and safety risks may be present. The intent of heating is to initiate a thermal runway which is when safety risks increase. Testing indicates that the amount of time to initiate thermal runaway from heating can vary widely depending on many factors, including REESS design, chemistry, and cell type, as well as heater type and placement. Potential variability related to each of these factors further calls into question whether the agency's proposal is objective, repeatable, reproducible, and reflective of real world conditions.

Further modifications are also needed to address SOC concerns. In S13.3 of the proposed regulatory text, NHTSA specifies that the REESS be initially set between 90 and 95 percent SOC. For hybrid-electric vehicles, vehicle control functions at a SOC less than 90%. Therefore, it is not possible for REESS of hybrid-electric vehicles to be at 90-95% SOC under normal vehicle control. S13.3 specifies that the REESS casing is opened, but the sealing of the REESS may be compromised depending on the battery design. For designs that use plastic casings, such as NiMH batteries, melting of the casing occurs and a warning may not be generated. This provides further justification for adopting a technical documentation approach until such time a more suitable test procedure can be developed.

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[8] *See Section 1.a of these comments.*

<u>Warning in the event of operational failure of REESS vehicle controls.</u> Auto Innovators supports the proposed technical documentation approach and recommends that the requirements be placed in general agency regulation as opposed to FMVSS, for the reasons previously stated.

i. Protection against water exposure.

Auto Innovators supports the agency's proposal to adopt the GTR No. 20 physical water test requirement, but requests that NHTSA also consider allowing for component-level testing (with vehicle controls in place for controlling the REESS function) with supporting technical documentation as an alternative compliance option. This is to help minimize test burden in demonstrating compliance with the requirements in cases where different vehicle makes and models may share a common electric powertrain design but differ based on other vehicle characteristics (e.g. ground clearance, etc.).

<u>Vehicle washing test.</u> Auto Innovators is not opposed to the inclusion of this test in FMVSS, but additional clarification is needed for various aspects of the test procedure. For example, the agency should specify a reasonable maximum time for the test duration (above three minutes). We also request that NHTSA set the time for post-test isolation checks to 12 hours (as opposed to 24 hours) to minimize overall test time burden. Regarding water salinity levels, a large amount of water will be needed, and the reproducibility of salinity levels is challenging. We therefore urge the agency to adopt the same requirements as UN R100.03 (S1) and remove salinity level requirements from FMVSS 305a.

<u>Driving through standing water test.</u> Auto Innovators recommends that the agency harmonize this test procedure with UN R100.03. Given the performance criteria, salinity is unlikely to make a difference in performance and would be an unnecessary addition to the test/requirement. Furthermore, we have practicability concerns given that a large amount of water will be needed for a pool of standing freshwater with 10 cm in depth, and the difficulty of establishing and maintaining the required salinity levels. Consistent with our comments on the vehicle washing test, we request that NHTSA set the time for post-test isolation checks to 12 hours to minimize overall test time burden.

<u>NHTSA consideration of submersions.</u> Auto Innovators agrees with NHTSAs assessment that more analysis is needed to understand potential field risks before determining whether additional test requirements should be required. Catastrophic flooding is an example of extreme environmental conditions that should perhaps not be addressed by regulatory requirements covering normal operating conditions. However, we support additional NHTSA efforts to document battery conditions after such events as part of the agency's broader research into EV battery safety. We further recommend harmonizing with UN R100.3.

j. Miscellaneous GTR No. 20 Provisions Not Proposed.

The NPRM lists several areas where the agency has decided not to include certain aspects of GTR No. 20 as part of its rulemaking proposal.

- **REESS Vibration Requirements.** Auto Innovators agrees with the agency's rationale for not including a vibration test in FMVSS No. 305. The specified fixtures for the vibration test may be different or incompatible with the test vehicle leading to a test result that is not representative of real-world conditions.

- **REESS Thermal Shock and Cycling.** We agree with the agency's decision. The test requirements in UN Model Regulations section 38.3 T2 are sufficient.

- **REESS Fire Resistance.** Auto Innovators agrees with NHTSA. Similar to the Transport Canada data referenced in this NPRM, we agree that a test duration of under 10 minutes is insufficient to induce significant internal heating. The only potential value here relates to ignition of external materials. Additionally, an explosion is generally not possible in the presence of active fire (i.e., flame) since flammable gases are burned as they are produced and not allowed to collect. Hence, the performance criteria of "no explosion" is not relevant.

- **Low State-of-Charge (SOC) Telltale.** We agree with the agency's decision not to include this GTR No. 20 requirement. Manufacturers typically provide SOC information to drivers already so there is no need to regulate this aspect of performance.

2. Comments on Emergency Responder Guide Proposal

In general, Auto Innovators supports the agency's proposal to require the submission of standardized ERGs and to provide a mechanism whereby first responders can access this information in an easily accessible way. However, we recommend several changes be considered as the agency seeks to develop the final rule.

Auto Innovators supports including ERG requirements in general regulation.
NHTSA has requested comments on whether the requirement for ERGs and rescue sheets would be better placed in a general agency regulation than in proposed FMVSS No. 305a. Auto Innovators strongly supports and recommends that any requirements related to ERGs be placed in general regulation as they are not appropriate to include these requirements in FMVSS. ERGs and first responder rescue sheets are inherently subject to individual OEM interpretation of the ISO standard and, as proposed, the requirements are not stated as an objective standard as required by the Safety Act. Therefore, the reporting requirements should not be subject to the same recall and remedy obligations for FMVSS compliance. In addition, given that vehicle specific ERG information will be submitted and maintained in an electronic format and accessible through the NHTSA website and/or other complimentary means (as discussed below), it does not seem reasonable that any perceived instances of non-compliance with the reporting requirements (e.g., format or subsequent corrections) should result in a recall of all vehicles covered by that ERG – particularly as the ERG has no direct bearing on the design, construction, or performance of the vehicle in and of itself.

If added to an FMVSS, more clarity will be needed to understand how the agency might consider safety non-compliance and recall issues when updating the documents or for any ISO standard changes, and whether exemptions may be provided in circumstances where updates to previously submitted documents may be required.

NHTSA should harmonize with the requirements of ISO 17840 and should not seek to develop unique requirements that are inconsistent with those developed in other markets.
In the NPRM, NHTSA seeks comment on the proposed format and layout of rescue sheets and ERGs in accordance with different parts of ISO-17840. Auto Innovators is supportive of NHTSA aligning the formatting requirements for ERGs with the aforementioned ISO Standard. However, we have concerns if the agency were to seek to develop US specific alternatives this could result in different ERGs being produced for the same vehicle (or similar vehicles) across different markets. We therefore recommend that NHTSA clarify its interpretation of ISO 17840 as the current standard on which all rescue sheets and ERGs should be based on.

NHTSA should consider the development of additional tools or applications to complement the information and resources that would be provided on the agency's website.
Auto Innovators supports NHTSA including ERGs on its website. However, it is important that the agency consider the potential limitations of this approach and whether there are opportunities for improving access for first responders, particularly during emergency response situations. It may not be intuitive for first responders to access "NHTSA.gov" and then navigate the site to access the information they need when they need it. Instead, the agency should consider the development of a dedicated website with a distinct URL that could be communicated and advertised to first responders as a free resource for ERG. Consistent with the NPRM, a link to this site could also be provided on the NHTSA website.

To ensure increased awareness among the safety community and first responders, this initiative should also be included as part of NHTSA's Traffic Safety Marketing.[9] We also request that NHTSA establish a process to ensure that ERGs are made available starting on the date when the subject vehicle is first introduced for sale in the United States. This is necessary to protect final design information, including pictures of the vehicle, prior to any planned media announcements. This would not compromise safety as the vehicle would not be available for sale for use by consumers on public roads.

Additionally, we also note that Euro NCAP has launched and continues to develop a mobile application that allows users to access information when they do not have access to cellular networks.[10] This effort has also been extended, in partnership with the International Association of Fire and Rescue Services, to include a desktop application that allows "911 call centers and command centers where there is a stable internet connection and large screens to pull up the rescue sheet for fast and close study."[11] We urge NHTSA to consider implementing these types of products and establishing strategic partnerships in addition to proposed website based approach.

The agency should also provide clear information and guidance for how information will be uploaded to the NHTSA website to ensure the timeliness and accuracy of information, and to the extent necessary, where corrections or supplemental information might also be made available.

3. Comments on Phase 2 GTR No. 20 Approaches

NHTSA seeks comment on various aspects of the GTR No. 20 Informal Working Group (IWG) Phase II activities. These issues are discussed in more detail, below.

Electrolyte release and venting from the REESS. NHTSA seeks comment on four key aspects related to electrolyte release and venting from the REESS:

- ***How detection methods (chemosensors and gas detection methods) may best be utilized in a vehicle level test procedure for both normal operating conditions and post-crash scenarios.*** As previously discussed, gas detection methods may not be practicable at the vehicle level. However, gas detection methods at a cell -level venting condition (*based on SCTR or possibly other methods to incite venting*) could reasonably be used to determine the vent gas chemical compositions and the rate of vent gas release as well as other venting conditions. Determining the characteristics of particulates (*e.g. type, size, etc.*) from cell venting may be less readily obtainable. It may be more appropriate to instead develop an assessment based on the

[9] https://www.trafficsafetymarketing.gov/
[10] https://www.euroncap.com/en/about-euro-ncap/timeline/euro-ncap-launches-euro-rescue-free-downloadable-rescue-information-for-first-responders/
[11] https://www.ctif.org/news/euro-ncap-ctif-releases-online-desktop-version-euro-rescue-app

materials within the cell design and how these may be compared to a standard to estimate the amount of sustainably airborne particulates may be released and/or have a reasonable opportunity to cause potential harm. We suggest additional research to identify whether alternative test procedures can be developed to evaluate this aspect of performance, including the potential placement of sensors, and the extent to which test procedures conducted in closed environments may be representative of real-world conditions.

In a thermal runaway event, if the rate of any cell-to-cell propagation is known, the cell-level data could be extrapolated to reflect the rate of release and chemical composition from a battery experiencing SCTR. These conditions could be used to either directly or indirectly assess the risk to occupants and/or others in close proximity to an affected vehicle. For instance, if a non-hazardous surrogate gas can be identified and released from a battery in a vehicle at a representative rate, various locations about the vehicle and within the cabin could be monitored for a rise over ambient of the surrogate gas. This rise over ambient could inform how much real battery vent gas would be expected at a location of interest at any point in time following a SCTR event. This, coupled with the chemical composition from cell testing, may allow correlation to what mixture of chemicals from the cell is present over time. This can be evaluated to a standard, such as the US EPA Acute Exposure Guideline Level (AEGL) or US CDC Immediately Dangerous to Life or Health (IDLH) thresholds to understand whether a potential hazard is developed at a given location and at what time.

- ***How to best manage gases and particulates emitted from the REESS for both normal operating conditions and post-crash scenarios.***
  Lithium-ion batteries do not produce gases and/or particulates as a part of normal operation so there is no need to regulate this for normal operating conditions. For gases and particulates produced post-crash, an approach of limiting exposure inside the passenger compartment may be most appropriate.

- ***Which gases generated in and vented from Li-ion batteries should be focused on for all types of REESS chemistries and are anticipated to remain relevant as REESS chemistry and technology changes in the future.***
  Among papers reviewed and internal analysis performed, CO appears to consistently be the vent gas of interest for Li-Ion chemistries. If the gas that dominates the risk (CO) can be demonstrated to be managed adequately, and if the gases tend to move as a bulk mixture (*which we understand they substantially do*), then the other gasses can be dismissed so long as the CO gas is kept out of the hazard range for the relevant locations and times. However, it is not possible to reasonably predict future technologies and how these might be addressed through regulation. Any current or future requirements should be based on available data and should avoid unintentionally limiting innovation.

- ***Practicable methods to verify the occurrence of electrolyte release and venting and to quantify the vented gases and vapors.***
  Auto Innovators recommends focusing on a limited number of critical gases with an emphasis on any release or venting that may impact occupant locations. We also suggest utilizing "dosing" measurement methods (*i.e., concentration and time duration*). Approaches such as controlled cell-level testing with a corresponding gas composition determination could also be considered with relevant data being extrapolated to evaluate performance at a system level (based on other known behaviors of the system (*e.g., thermal propagation rate*)).

Single-cell thermal runaway. In the NPRM, NHTSA seeks comment on the proposed reporting requirements to mitigate the risk of SCTR due to an internal short-circuit in a single cell of the REESS and the performance test under consideration in GTR No. 20 Phase 2. Based on our initial assessment the proposed reporting requirements appear to be reasonable. However, it should be clearly defined within the reporting requirements that, while the proposed technical documentation requirements (for proposed S13(d)(3)) would require a description of and/or result from a vehicle level assessment, such an assessment may not involve ore require physical testing.[12] It is also paramount that any detailed information describing competitive information among OEMs and battery manufacturers be held in confidence and not be subject to public disclosure. If information provided by the manufacturer is subject to public disclosure, then competitive information must be protected, and should only be reviewed with, but not provided to, NHTSA upon request.

REESS vibration requirements. NHTSA seeks comment on the safety need that would warrant an update to a more stringent vibration test than that already in UN 38.3 Test T3, as well as manufacturer practices that have been implemented to avoid reliability issues and assure customer satisfaction in the field. First, in our view, UN38.3 T3 is not representative of vehicle loads and allows for fixturing that is different from the mounting in the vehicle. We therefore recommend that this not be considered for inclusion in FMVSS. Second, the industry standard uses other means, including physical testing and/or virtual analysis to assess durability. Therefore, introduction of new vibration profiles in regulation is unnecessary.

4. Proposed Compliance Dates

For requirements to provide emergency response information, Auto Innovators agrees with the agency's proposal to provide a compliance date one-year after publication of the final rule. However, we have concerns regarding the lead time provided for complying with other requirements outlined in the rule. A comprehensive assessment of both existing and planned products needs to be conducted and it is not yet known in all cases whether substantive design changes will be required. While we appreciate the agency's efforts to harmonize with aspects of GTR No. 20 and other relevant international standards, there are differences that need to be accounted for as part of the overall product development cycle. We therefore request an additional two years, with optional early compliance (i.e., four-year lead time). An additional year should also be provided for small-volume manufacturers, final-stage manufacturers, and alterers, as proposed (i.e., five-year lead time).

We appreciate the opportunity to provide comments in response to the NPRM. Please contact Auto Innovators staff if you have any questions related to these comments, and we look forward to providing any input to help resolve outstanding issues in a timely manner.

Sincerely,

Sarah Puro
Vice President, Safety and Technology Policy
Alliance for Automotive Innovation

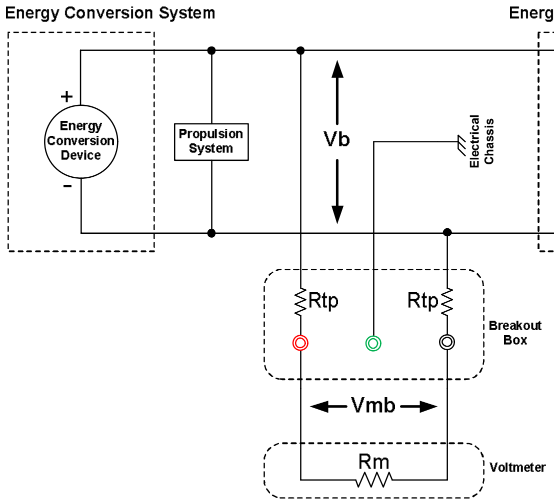
Attachments: ***Appendix 1 – Additional clarification questions and proposed regulatory text changes.***

[12] https://www.federalregister.gov/d/2024-07646/p-911

Appendix 1

Additional Clarification Questions and Proposed Regulatory Text Changes
In addition to the comments provided in the main body of this document, the following includes a listing of further clarification questions and suggested edits to the proposed regulatory text.

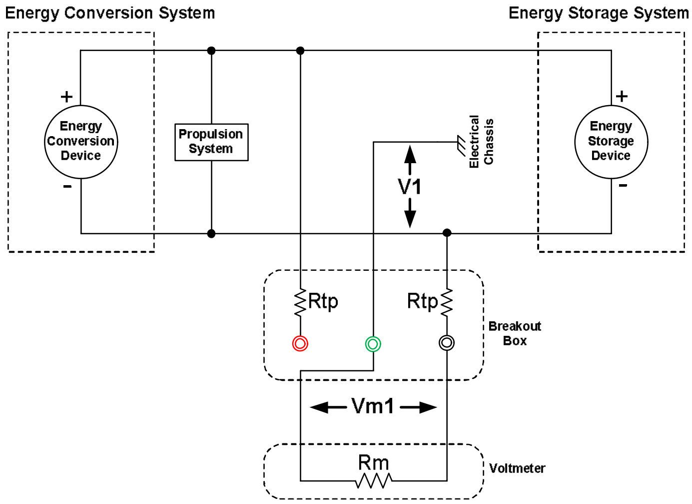
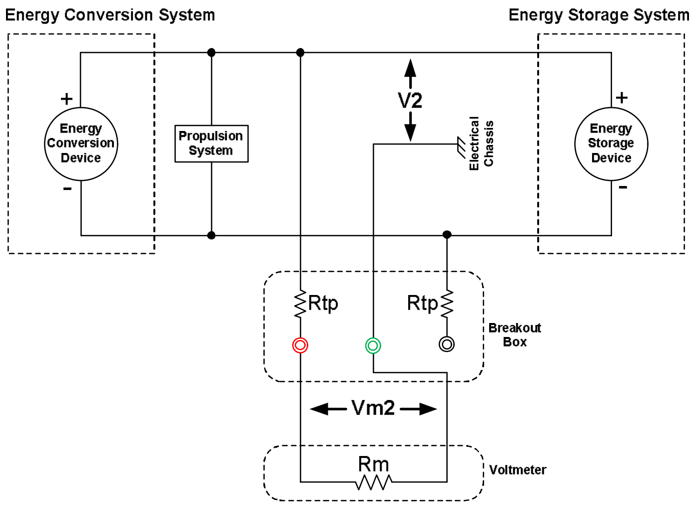
Section number	Comments and suggested redline edits on the proposed regulatory text
S 4. Definitions	Parking mode – the statement of "vehicle power is turned off" can be ambiguous. Is the agency referring to HV power (or motive power) is off? Or that all power is turned off? This may be relevant for any required actions to be taken while in parking mode.
S6.4	We recommend remove requirements for AVs without manual driving controls; NHTSA has not provided rationale for why any warning needs to be provided to the "front row occupant"; the occupant cannot take any action based on the visual warning.
S7.1.2	We propose NHTSA revise S7.1.2 as follows: Voltage Vb is the voltage across the two terminals of the voltage source as shown in Figure 1. Voltage Vb is measured through a safety breakout box with inline resistors that reduce the maximum possible current exposure to a level safe for human contact. One inline resistor of the resistance value Rtp is between the testing access point and the positive side of the high voltage source. Another inline resistor of the resistance value Rtp is between the testing access point and the negative side of the high voltage source. The internal resistance of the voltmeter is Rm. The reading of the voltmeter connected to the two testing access points is Vmb. Voltage Vb is determined by the formula in Figure 1. ~~Voltage Vb is measured across the two terminals of the voltage source.~~ Before a vehicle crash test, Vb is equal to or greater than the working voltage as specified by the vehicle manufacturer. This calculation formula should be used when installing Rtp in the safety breakout box. Note: If the access point used does not include inline resistors to reduce potential current exposure levels, 0 should be substituted for Rtp in all formulas. The text and corresponding diagram in Figure 1 should also be revised as follows:

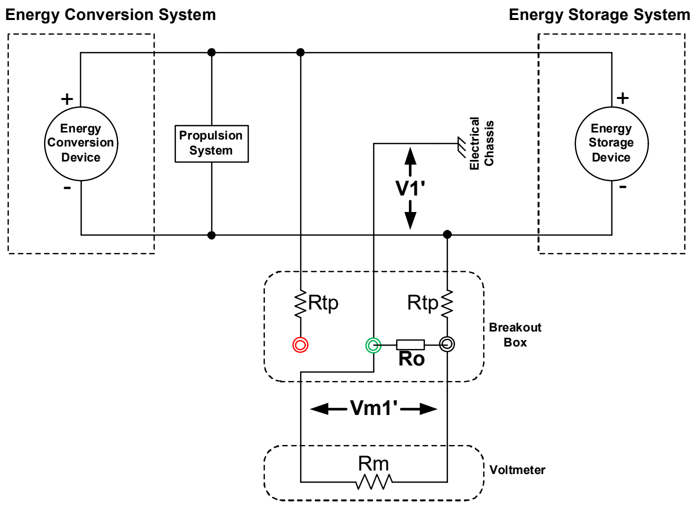
<table>
<tr><th>Section number</th><th>Comments and suggested redline edits on the proposed regulatory text</th></tr>
<tr><td></td><td>


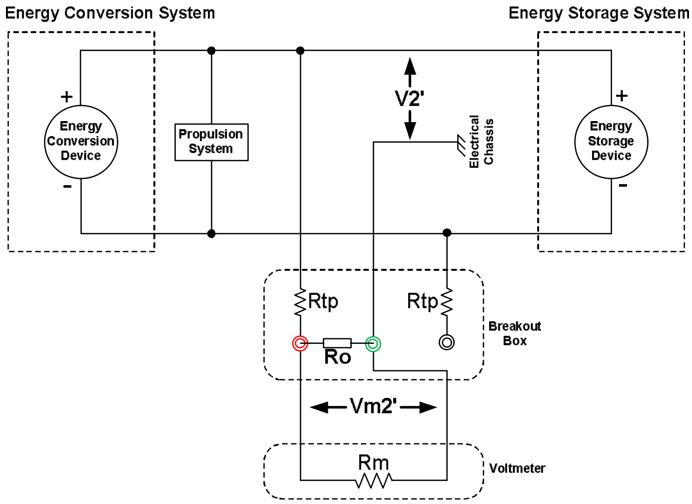
$$V_b = (1+2R_{tp}/R_m)V_{mb}$$

Figure 1. ~~Voltage Measurements of the High Voltage Source.~~ Measurement for Vb Voltage Between the Positive Side of the High Voltage Source and the Negative Side of the High Voltage Source through a Safety Breakout Box with Inline Resistors.
</td></tr>
<tr><td>S7.1.3</td><td>
We propose NHTSA revise S7.1.3 as follows:
~~Voltage V1 is measured between the negative side of the high voltage source and the electrical chassis as shown in Figure 2. Voltage V2 is measured between the positive side of the high voltage source and the electrical chassis as shown in Figure 3.~~ Voltage V1 is the voltage between the negative side of the high voltage source and the electrical chassis as shown in Figure 2. Voltage V1 is measured through a safety breakout box with inline resistors. The reading of the voltmeter connected to the two testing access points is Vm1. Voltage V1 is determined by the formula in Figure 2. Voltage V2 is the voltage between the positive side of the high voltage source and the electrical chassis as shown in Figure 3. Voltage V2 is measured through a safety breakout box with inline resistors. The reading of the voltmeter connected to the two testing access points is Vm2. Voltage V2 is determined by the formula in Figure 3.

The text and corresponding diagram in Figure 2 should also be revised as follows:
</td></tr>
</table>

Section number	Comments and suggested redline edits on the proposed regulatory text
	 V1 = (1+Rtp/Rm)Vm1 Figure 2. Measurement for V1 Voltage Between the Negative Side of the High Voltage Source and the Electrical Chassis through a Safety Breakout Box with Inline Resistors. The text and corresponding diagram in Figure 3 should also be revised as follows:  V2 = (1+Rtp/Rm)Vm2 Figure 3. Measurement for V2 Voltage Between the Positive Side of the High Voltage Source and the Electrical Chassis through a Safety Breakout Box with Inline Resistors.
S7.2.1	We propose NHTSA revise S7.1.3 as follows: If V1 is greater than or equal to V2, insert a known resistance (Ro) between the negative side of the high voltage source and the electrical chassis. With the Ro

Section number	Comments and suggested redline edits on the proposed regulatory text
	installed, ~~measure~~ the voltage (V1’) as shown in Figure 4 is between the negative side of the high voltage source and the electrical chassis. The measured voltage across the resistor Ro is Vm1’. Determine V1’ and calculate the electrical isolation resistance (Ri) according to the formula shown. Divide Ri (in ohms) by the working voltage of the high voltage source (in volts) to obtain the electrical isolation (in ohms/volt). The text and corresponding diagram in Figure 4 should also be revised as follows:  $V1' = (1+Rtp/Ro+Rtp/Rm)Vm1'$ $Ri = (Ro+Rtp)(1+V2/V1)((V1-V1')/V1')$ Figure 4. ~~Measurement for V1’ Voltage Across Resistor Between Negative Side of the High Voltage Source and Electrical Chassis~~ Measurement for V1' between Negative Side of the High Voltage Source and the Electrical Chassis When a known Resistor Ro is Inserted Through a Safety Breakout Box with Inline Resistors
S7.2.2	We propose NHTSA revise S7.1.3 as follows: If V2 is greater than V1, insert a known resistance (Ro) between the positive side of the high voltage source and the electrical chassis. With the Ro installed, ~~measure~~ the voltage (V2’) as shown in Figure 5 is between the positive side of the high voltage source and the electrical chassis. The measured voltage across the resistor Ro is Vm2’. Determine V2’ and calculate the electrical isolation resistance (Ri) according to the formula shown. Divide Ri (in ohms) by the working voltage of the high voltage source (in volts) to obtain the electrical isolation (in ohms/volt). The text and corresponding diagram in Figure 5 should also be revised as follows:

Section number	Comments and suggested redline edits on the proposed regulatory text
	 $V2' = (1+Rtp/Ro+Rtp/Rm)Vm2'$ $Ri = (Ro+Rtp)(1+V1/V2)((V2-V2')/V2')$ Figure 5. ~~Measurement for V2' Voltage Across Resistor Between Positive Side of the High Voltage Source and Electrical Chassis.~~ Measurement for V2' Between Positive Side of the High Voltage Source and the Electrical Chassis When a Known Resistor Ro is Inserted Through a Safety Breakout Box with Inline Resistors.
S7.5	This provision is inconsistent with ECE practice where the energy of a Y capacitor is the greater of 0.5Cy x V11^2 or 0.5Cy x V2^2; adopt the same method for determining the energy of a Y capacitor as ECE 100.03.
S8.2	Revise text to clarify that low electrical energy post-crash is an option. After each test specified in S9 of this standard, each high voltage source in a vehicle must meet one of the following electrical safety requirements: electrical isolation requirements of subparagraph (a), the voltage level requirements of subparagraph (b), or the physical barrier protection requirements of subparagraph (c). High voltage capacitors in the electric power train may also meet electrical safety requirements using the low-energy requirements of subparagraph (d). We proposed NHTSA update the proposed regulatory text as follows: After each test specified in S9 of this standard, each high voltage source in a vehicle must meet one of the following electrical safety requirements: electrical isolation requirements of subparagraph (a), the voltage level requirements of subparagraph (b), ~~or~~ the physical barrier protection requirements of subparagraph (c), **or the low-energy requirements of subparagraph (d)**.
S8.2	Restate the opening sentence of S8.2 Electrical Safety as "After each test specified in S9 of this standard, each high voltage source in a vehicle must meet

Section number	Comments and suggested redline edits on the proposed regulatory text
	one of the following electrical safety requirements: electrical isolation requirement of subparagraph (a), the voltage level requirement of subparagraph (b), the physical barrier protection requirement of subparagraph (c), or the low-energy requirements of subparagraph (d)" to make it clear that only one method is necessary.
S11.1	We recommend allowing of pack-level testing. Propose to add the underlined text in S11.1(a): *"During the test, there shall be no evidence of electrolyte leakage, rupture, venting, fire, or explosion of the REESS as verified by visual inspection without disassembly of the vehicle or REESS."*
S12 (ALL)	Allow pack-level testing for all REESS performance tests to harmonize with ECE 100.03, which allows for performance testing at either the pack or vehicle level.
S12.1, 12.2, 12.3	The term "traction side" is unnecessary and differs from S12.5, which provides the same connection instructions without using this term. As proposed, allowing the manufacturer to specify an appropriate connection method is sufficient. We propose NHTSA remove the underlined text in S12.1, 12.2, 12.3: "(a) A breakout harness is connected to the traction side of the REESS. Manufacturer may specify an appropriate location(s) and attachment point(s) to connect the breakout harness."
S12.1	Fully align SOC adjustment/requirements with ECE 100.03 ("around the middle of normal operating range")
S12.2	Allow for SOC adjustment to allow assessment of transition to protection. Allow pack-level testing. Propose to revise the underlined text in S12.2: *"The over-discharge test is conducted at ambient temperatures between 10 °C and 30 °C, with the vehicle REESS initially set ~~between 10 and 15~~ below 50 percent SOC. For a vehicle with on-board energy conversion systems such as an internal combustion engine or a fuel cell, the fuel supply is set to the minimum level where active driving possible mode is permitted. The following steps are conducted to evaluate the vehicle's over-discharge protection controls:"* *"(d) The vehicle switch or device that provides power from the REESS to the electric power train is set to the activated position ~~or the active driving possible mode~~."*
S12.5	Fully align with ECE 100.03 SOC requirement of >95%. For hybrid-electric vehicles, 90-95% SOC is not appropriate.

Section number	Comments and suggested redline edits on the proposed regulatory text
S12.7	Remove requirement for documentation pending maturation of development of a practical test procedure to evaluate performance of vehicle controls in low temperature conditions; OR remove the documentation submission obligation of a form that is subject to public disclosure.
S12.8	Remove the documentation submission obligation from a form that is subject to public disclosure.
S13	Allow assessment of a single vehicle operational condition (could be worst case). Remove the documentation submission obligation for a form that is subject to public disclosure.
S14	Request for harmonization with current procedures (internal or global procedures); change to 12-hr wait time (from 24-hr wait time) to support vehicle prototype DV efficiency.
S13.1	The test method, which is chosen to show the safety functions on REES shouldn't be fixed like S13.2. The OEM should define his own risk-mitigation strategy to avoid hazardous situations. Technical open solutions should be developed by manufacturer based on the state of art.
S13.3	For hybrid-electric vehicles, vehicle control functions at a SOC less than 90%. Therefore, it is not possible for REESS of hybrid-electric vehicles to be at 90-95% SOC under normal vehicle control.
S13.3 (b)	Modification of a battery system to implement a trigger system without support of the OEM is risky, because of potential damage to the manufacture specific safety design and therefore deviating behavior is to be expected.
S13.3 (c) & (g)	Alternative trigger methods should be allowed. 600°C peak temperature is so high, that general parts of the battery system could be damaged and the safety function and constructions, which would work in case of an internal short circuit could be damaged and won't be workable. Temperature for initiation should be described by a manufacturer based on technical design and operational temperature slots. Specificity is needed to implement required testing equipment. We propose NHTSA revise the underlined text in S13.3 (c): "A heater that achieves a peak temperature of 600°C ~~within 30 seconds~~ is attached to one or more cells in the REESS in a manner to put at least one cell in the REESS into thermal runaway. <u>The temperature shall be measured directly at the heater body surface, such as the backside of the heater, during testing. The REESS casing may be opened to facilitate placement of the heater and associated thermocouples and wiring.</u>"

Section number	Comments and suggested redline edits on the proposed regulatory text
	We propose NHTSA revise the underlined text in S13.3 (g): "The heater within the REESS is activated to achieve 600 °C within ~~30~~ 180 seconds. The heater shall remain operational until thermal runaway is initiated in at least one cell."
S13.3 (i)	Alternative trigger methods should be allowed. A definition consistent with UN R100.03 S5 or GB38031 should be taken to check if a TR happened. If no TR happens, an observation period with measuring of the temperature would be necessary to check if a TR could occur. We propose NHTSA revise the underlined text in S13.3 (i): "The test is terminated after activation of the warning or after four minutes of ~~activating~~ the heater in the REESS achieving 600°C, whichever comes first. If the test is terminated without initiating thermal runaway, the test can be repeated provided that the requirements in S13.2 and S13.3 are still met."