

NPRM NHTSA-2024-0012 FMVSS No. 305a Electric-powered Vehicles: Electric Powertrain Integrity General Technical Regulation 20

Mechanical Integrity Test

Issue

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. NHTSA requests that commenters provide data to substantiate their assertions.

Comment

Nikola requires our battery pack manufacturers to test using UL 2580 standard which includes a crush test. Since GTR 20 does not require this test for HDVs, suggest NHTSA allow manufactures to meet the mechanical integrity requirements using UL 2580 or their own method.

Mechanical Shock Test

Issue #1

NHTSA seeks comment to inform our research on a mechanical shock test for REESS on heavy vehicles to evaluate post-crash safety at a component level.

Comment #1

Although GTR20 and FMVSS do not require crash testing for HD vehicles, Nikola believes that it is prudent to have a system on our vehicles to isolate high voltage in the event of an impact to the REESS.

Nikola with the expectation for NHTSA to eventually make a rule suggest the existing passenger car tests would potentially be used as the basis for testing, Nikola designed and tested our vehicles to those standards. Nikola replicated the most likely crash scenarios of a passenger car impacting a Heavy-Duty vehicle.

Nikola used the moving deformable barrier impact tests from FMVSS 208 (frontal), 214 (side) and 305 (rear).

Issue #2

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.

Comment #2

Test facilities are not equipped currently with a test apparatus capable of testing Nikola's entire REESS or subset. If crash tests are established for HD vehicles, Nikola suggests using the existing crash requirements used for passenger vehicles as a baseline. This is Nikola's direction and we recommend those requirements for any vehicle with HV components in the strike zone of those standards. (This would effectively exempt those components that are installed on vehicles that are above a 'to be established' height.)

Issue #3

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 (10,000lb). Specifically, NHTSA seeks comment and recommendations on other applicable safety tests and corresponding objective performance criteria to evaluate the propulsion system crash safety performance of vehicles with a GVWR greater than 4,536 kg (10,000lb). 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.

Comment #3

Nikola has used and recommends the moveable deformed barrier as it is more representative of a passenger vehicle. NHTSA should also consider allowing HD vehicle manufacturers to use a mule for crash testing in place of a complete truck or tractor.

Assessing Fire or Explosion in Vehicle Post-Crash Test

Question

Do you agree/disagree with the agency's proposal?

Answer

Agree, but should also be required for HD vehicle, should impact testing be required.

Assessing Post-Crash Voltage Measurements

Issue

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.

Comment

Agree

Electrolyte Spillage Versus Leakage

Issue #1

NHTSA seeks comment on the inclusion of a post-crash electrolyte leakage requirement in FMVSS No. 305a and the necessity and relevance of such a requirement for current EVs. Specifically, NHTSA seeks comment on whether this requirement is still relevant given today's propulsion battery technologies and if it is still necessary based on the safety incidents observed in the field or in crash tests.

Comment #1

This requirement is not deemed relevant to Nikola as the batteries are protected beyond any concern that leakage could be a concern. Though we recognize that it may be possible if an OEM allows direct contact to the battery's casing.

Issue #2

NHTSA seeks comment on whether a 5-liter maximum amount of electrolyte permitted to be leaked is still relevant and requests commenters to provide data based on safety incidents observed in the field or in crash tests to substantiate their assertions.

Comment #2

The maximum amount of 5L is a large amount, it is Nikola's belief that this requirement is not relevant. As electrolyte leakage would occur at the cell level, any observed electrolyte leakage that can be observed from outside of the battery's casing should be deemed a failure.

Issue #3

NHTSA seeks comment on and recommendations regarding electrolyte leakage detection methods and how these detection methods can discern between the presence of electrolyte and the presence of other liquids such as coolant.

Comment #3

Nikola has begun testing commercially available electrolyte vapor detection sensors, which could be used for discerning between the presence of electrolyte and the presence of other liquids. Efficacy of these sensors to detect small amounts of electrolyte leakage at the cell level is still pending and requires design changes in how the battery cells are housed. At this point, we don't have enough data to recommend the usage of such sensors for the general application, regardless of battery design.

Performance Criteria for Normal Vehicle Operations - General

Question #1

Do you have any questions or concerns based on the agency's proposal?

Answer #1

Recognizing that there is not a better option than to follow GTR 20 requirements, this seems to be the best course of action.

Issue #1

NHTSA also requests comment in an Appendix to this preamble on the IWG's continuing work on venting in Phase 2 of the GTR

Comment #1

Equipment for the detection of the venting gas is still under development. The Chemo-sensors being studied need to be completed before a decision can be made.

Overcharge Protection / Over-Discharge Protection

Question

Do you have any questions or concerns based on the agency's proposal?

Answer

Overcharge testing can only be accomplished at a vehicle level on Battery Electric Vehicles. It is not feasible on HV systems in a hybrid configuration or fuel cell.

Overcurrent Protection

Question

Do you have any questions or concerns based on the agency's proposal?

Answer

No Objection to AC overcharge being exempted.

Over-Temperature Protection

Question

Do you have any questions or concerns based on the agency's proposal?

Answer

This approach does not include hybrid or fuel cell vehicles, therefore battery component level testing makes more sense.

External Short-Circuit Protection

Question

Do you have any questions or concerns based on the agency's proposal?

Answer

No Objection

Low-Temperature Protection

Question

Do you have any questions or concerns regarding any aspects of the agency's proposal?

Answer

Nikola has no concerns regarding this requirement as CARB requires manufacturers to monitor and diagnose the powertrain. Low temperature REESS operation is part of that monitoring.

Safety Need

Issue

NHTSA requests comments on whether the proposed document requirement would be better placed in a general agency regulation than in proposed FMVSS No. 305a.

Comment

As single cell thermal runaway does not always require a warning (if it is single cell fault tolerant) then it makes sense to not require a warning for SCTR. However, a thermal runaway warning should be required as discussed later. UL 2580 does have a simple requirement for forcing a cell into SCTR that leaves the method up to the manufacturer but give only a time limit on how long until runaway occurs.

Question

Do you have any questions or concerns based on the agency's proposal?

Answer

Though there should be SCTR mitigation built into the REESS, requiring a warning can absolutely mitigate the risks that would occur due to a thermal runaway, the risks to the user and other nearby property. It would not prevent the further destruction of the battery or the propagation of the runaway to the other cells, but it would still allow the user to take action to put the vehicle in a better location or at minimum, allow them to get a safe distance from the vehicle.

NHTSA SCTR Documentation Proposal

Question

Do you have any questions or concerns based on the agency's proposal? Are there aspects of the proposal that should be reconsidered? Please provide additional detail, where possible.

Answer

Some of the technical data needed to meet the documentation requirement is proprietary to the vehicle manufacturer more for the battery manufacturer. It has been Nikola's experience when working with the battery manufacturer if it is proprietary it is not shared. This includes any test procedures and test results. Although Nikola is not against requiring documentation, the requirement needs to be incorporated to include battery manufacturers.

It was written earlier in the NPRM that the technical documentation would only be provided to NHTSA upon request. If this is the case for this information, then the Confidential Business Information under 49 CFR PART 512 needs to be allowed.

NHTSA's Decision Not to Propose a Warning Requirement

Issue

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. 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.

Comment

While a warning should not replace an SCTR risk mitigation strategy, not requiring a warning for a thermal runaway is a lax approach. UL 2580 has an SCTR test. Force a cell into thermal runaway and for 1 hour, the battery pack shall not show fire or explosion.

This should be a battery manufacturer requirement since the detection would come from the battery management system.

Thermal Event Warning

Issue

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 addition, NHTSA seeks input on the type of heater, the heater characteristics (power, peak temperature) and possible locations of the heater within the REESS to simulate a thermal event to trigger the warning. 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.

Comment

Thermal Event is defined as when the temperature is significantly higher than the normal operating conditions. "Significantly" and "Normal operating conditions" are defined by the manufacturer.

The rapid heat up of the surface of a cell from ambient to 600degC within 30s would create thermal shock to the cell that is not representative of internally generated heat and not representative of a naturally developing SCTR. Instead, Nikola recommends a nichrome wound wire around a cell, with the power being around 75W and a 5 minute target duration from start of heating to begin self-sustained thermal runaway. This will more closely represent a naturally occurring SCTR (e.g. due to internal short) and the proposed excessive thermal shock.

Location of the heater should be left up to the OEM or battery manufacturer, however it should generally be the theoretically "worst" case, meaning as far away as possible from the detection method.

Nikola agrees with the 3 to 5 minutes of detection method, however it may require redesign of any batteries currently in use to achieve that.

Question

Do you have any questions or concerns based on the agency's proposal?

Answer

If the warning is for occupants to quickly egress the vehicle, this seems to be a high enough priority to have a regulated audio/ visual warning. NHTSA is proposing to not have a warning for a thermal runaway but to require one for thermal event that is intended to inform occupants to egress the vehicle. The definitions of Thermal event and Thermal Runaway are being conflated.

Warning in the Event of Operational Failure of REESS Vehicle Controls

Question #1

Do you have any questions or concerns related to the agency's proposal?

Answer #1

Besides the technical documentation position discussed earlier, Nikola continues to monitor and warn the driver of a malfunction and manages safe operation of the vehicle. This is all documented in the monitoring and diagnostic documents required by CARB for powertrains.

Question #2

In section VI., NHTSA requests comments on whether the proposed document requirement would be better placed in a general agency regulation than in proposed FMVSS No. 305a. Is there a need to provide specific recommendations to NHTSA on this proposal as an interim measure?

Answer #2

If NHTSA is going to identify and require specific warning requirements and symbols, then incorporate within 305a like FMVSS 121, and FMVSS 105. Otherwise, put the documentation requirements in a separate standard.

NHTSA Water Exposure Proposal

Question

Do you have any questions or concerns related to the agency's conclusions and/or decision not to provide an alternative compliance option?

Answer

Include the warning as a requirement, not as an alternative compliance option is the right decision.

A. Vehicle Washing Test

Issue

Comments are requested on the merits of including the vehicle washing 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.).

Comment

For a vehicle washing test, salinity levels should not be a factor. Increasing the pressure does seem prudent as it will be the standard practice to use a pressure washer to clean the vehicles. However, unless the nozzle is smaller a higher flow rate will also be needed. Somewhere closer to IPX6 as the proposed is equivalent to IPX5.

NHTSA's Consideration of Submersions

Issue

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.

Comment

Salinity of the water impacts corrosion resistance of the enclosure. When exposed to salt spray, the enclosure (and connectors, etc.) see corrosion, which would impact and potentially cause deterioration of other characteristics of the battery pack (e.g. mechanical integrity, etc.) up to loss of protection against direct contact. UL2580 defines a salt spray test (section 40) to test against this. It would need to be assessed if the submersion in saline water significantly worsens the behavior when compared to the salt spray test per UL2580.

Question

Should Auto Innovators express general support for this initiative?

Answer

It has been industry practice to have an ERG submitted to NFPA. The first responder industry knows to go to this website first for information. Should NHTSA require ERGs, they should be required to be posted on the NFPA website. The content of the ERG should be standardized including vehicle identification and badging.

REESS Thermal Shock and Cycling

Issue

The agency seeks public comment on the safety need of a REESS thermal shock and cycling requirement, and requests commenters provide data to substantiate their comments and/or assertions.

Comment

UN 38.3 is an adequate test, as it only allows testing at a cell or module level. It does not require any testing of the assembled battery pack. Relying solely on the shipping requirements of the cells or modules is a low bar to set for EV safety.

REESS Fire Resistance

Issue

The agency seeks comment on excluding this fire resistance requirement from the FMVSS, and requests commenters provide data to substantiate their comments and/or assertions.

Comment

NHTSA is proposing to remove the fire resistance test because Canada conducted tests on EVs and ICEVs without explosions in either vehicle type during the test.

Unless the design of all of those vehicles did not consider the fire exposure test, all this proves is that the EV industry designed their vehicles to be able to withstand this test. Removing the requirement for US regulation could lessen the safety of the industry EV design.

Low State-of-Charge Telltale

Issue

NHTSA seeks comment on whether this GTR No. 20 requirement should be incorporated into proposed FMVSS No. 305a, and if yes, what the telltale should look like.

Comment

Regulating a requirement for low SOC would require standardizing when the light was to come on (specific REESS voltage or remaining range). I agree it should be left up to the OEM.

Emergency Response Information to Assist First and Second Responders

Question

Are there main features of ISO-17840 that should be considered instead of referring to specific versions of the ISO-17840 parts? Are there specific features not included in ISO-17840 that would further enhance first and second responders' operations?

Answer

Nikola follows the proposed format and includes the document on the NFPA website.

Issue #1

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.

Comment #1

Yes, as an additional resource.

Issue #2

NHTSA also requests comments on whether the requirement described in this section for ERGs and rescue sheets would be better placed in a general agency regulation than in proposed FMVSS No. 305a. More specifically, NHTSA requests comments on the pros and cons of having the ERGs and rescue sheet requirements in a regulation rather than in FMVSS No. 305a.

Comment #2

FMVSS is specific to the safety of the vehicle covering the components. This is not the place for FRG requirements as it is a document and should have a separate rule. However, 305a should reference or require the FRG and the rule location.