ALLIANCE
FOR AUTOMOTIVE
INNOVATION

July 17, 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; Fuel System Integrity of Hydrogen Vehicles; Compressed Hydrogen Storage System Integrity; 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 17, 2024, Federal Register Notice of Proposed Rulemaking (NPRM) on FMVSS No. 307 ("Fuel system integrity of hydrogen vehicles") and FMVSS No. 308, ("Compressed hydrogen storage system integrity").

Auto manufacturers remain committed to a net-zero carbon transportation future, and collectively, the auto industry has committed to investing more than $330 billion to bring exciting new electric vehicles (EVs) to market, including plug-in hybrid, battery, and fuel cell EVs. As manufacturers continue to make significant investments in hydrogen fuel vehicles, it is critical that complementary policies are in place to support more widespread adoption of these technologies, including the need to rapidly expand hydrogen fueling infrastructure to meet consumer expectations and demand.

In addition to advancements in alternate powertrain technology, manufacturers and suppliers are making significant investments to address the safety of both electric and hydrogen fuel cell vehicles. This is critical for establishing and maintaining consumer trust and providing necessary assurances to policymakers as new vehicles enter the marketplace. The industry has been proactive in engaging on this issue through involvement in international standards development efforts and ensuring robust performance standards are followed as vehicles are introduced in the United States and other parts of the world.

Harmonization is Critical to the Successful Introduction of Hydrogen and Fuel Cell Vehicles
Auto Innovators supports NHTSA efforts to establish FMVSS for both fuel system and storage system integrity. However, we have significant concerns regarding the extent to which the agency proposal deviates from the established Global Technical Regulation (GTR No. 13) on Hydrogen and Fuel Cell Vehicles. While we generally support the aspects of the NPRM where the agency has aligned its proposal with the GTR, areas of misalignment create regulatory uncertainty and increase the cumulative burden due to the need to modify vehicles to meet US-specific design and testing requirements. This incongruence adds unnecessary cost for OEMs and, ultimately, consumers with *de minimis*, if any, added safety benefits.

We request that the agency reconsider many aspects of its proposal to align it more closely with the latest version of GTR No. 13. The current GTR provides robust safety requirements that have been thoughtfully developed as part of a deliberative six-year process that included over 100 members consisting of government agencies, industry, and academia. While we recognize that NHTSA has flexibility in how it interprets this document for application in FMVSS, we request that the agency adopt a path forward that embraces consistency with the GTR. More specific recommendations on the technical aspects of the agency's proposal are discussed in more detail in the appendix section of this document, which seeks to address each of the questions included in the NPRM.

Recommend FMVSS No. 308 as an Equipment Level Standard

In addition to the need for greater harmonization, we also request that the agency reconsider its approach to FMVSS 308, which currently proposes the FMVSS be structured as a vehicle-level standard. The development, manufacturing, and quality assurance of compressed hydrogen storage systems (CHSS) require specific knowledge and facilities. Therefore, many vehicle manufacturers will acquire the CHSS from independent suppliers for installation to their vehicles. In such a case, the vehicle manufacturer will rely on the supplier for ensuring the compliance of the CHSS to the standard. It is also likely that the same CHSS will be installed to vehicles of different vehicle manufacturers. Therefore, compliance responsibility should be assigned to the CHSS supplier.

Scope of Rulemaking

Auto Innovators supports the NHTSA proposal to limit the scope of any vehicle-level performance requirements established within regulation only apply to light-duty vehicles (≤ 10,000 lbs. Gross Vehicle Weight Rating) at this time. This is to help minimize test burden and address practical limitations in running full scale vehicle tests involving heavier vehicles.

Test Procedure Tolerances

In general, GTR No. 13 specifies the target values (X) and their allowable tolerances (±α) and are indicated in GTR No. 13 Table 10 in Section O of Part I. In the GTR, the target value is used to set the test equipment while the allowable tolerance is given for ensuring the performance of the test facility/equipment. However, as NHTSA proposed these test parameters in the NPRM, these targets were transformed into a range [between (X-α) and (X+α)] and there is no target value indicated. The NPRM may be read to require compliance in all parameters in the range; therefore, the manufacturer would have to set the test equipment at the worst-case values of either (X-α) or (X+α) and potentially test at points in between.

For example, the low pressure of the pressure cycling is 2 ± 1 MPa in GTR No. 13. In this case, the test laboratory will set the equipment to 2 MPa and ensure that the all the cycles will be conducted with the low pressure at 1MPa to 3MPa. In NPRM, "between 1MPa and 2MPa" is proposed contrary to GTR No. 13. In this case, the manufacturer has to set the low pressure as close as possible to 1MPa to test under the severest cycling condition. This is contrary to the purpose of this test. Auto Innovators strongly disagrees with NHTSA's description of the tolerances, which are significant deviations from GTR No. 13 and result in an impractical implementation of these tests.

Lead Time Considerations

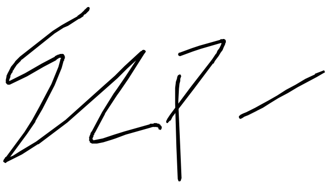
Auto Innovators is concerned with the proposed lead time suggested in the NPRM. We have not fully assessed the cumulative impact of the lack of harmonization with GTR No. 13, and the accompanying additional regulatory impact that this creates by requiring US-specific design and testing requirements without a clear added safety benefit. However, based on our initial assessment, we anticipate at least 5 additional years will be required beyond the one-year compliance date in the proposed rule. This time is necessary to allow manufacturers to change designs, adjust hardware procurement, and make software changes to vehicle safety systems.

We also note that there are conflicting compliance dates listed in the NPRM. In the initial Dates section, NHTSA indicates a proposed compliance date as “the September 1st that is two years subsequent to the publication of the final rule.”[1] However, in the lead time section, it is stated that “NHTSA is proposing that the rule take effect the September 1st the year after the final rule is published.”[2] While the association’s priority is to ensure sufficient lead time is provided, we also urge the agency to clarify the inconsistency on lead time when it publishes the final rule.

Conclusion
Auto Innovators supports NHTSA efforts to establish FMVSS for both fuel system and storage system integrity. However, we request that the agency update its proposal to more closely align with the requirements of GTR No. 13. More specific recommendations for improving alignment with the GTR are discussed in more detail in the attached appendix, which includes industry responses to the various questions posed by NHTSA throughout the NPRM. We look forward to working with the agency to help resolve any issues that would result in substantial overall misalignment with the GTR requirements, as even seemingly minor deviations impact the ability of manufacturers to minimize burden by consolidating certification testing. This is particularly impactful when tests are conducted as part of a series, where an entire series may need to be rerun to account for unnecessary differences, which then creates unnecessary cost to consumers if there is insufficient justification for changes.

Please contact me if you have any questions.

Sincerely,



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

Cc: Mr. Ryan Posten

[1] https://www.federalregister.gov/d/2024-07116/p-6
[2] https://www.federalregister.gov/d/2024-07116/p-541

Appendix 1

The following appendix provides Auto Innovators' responses to the proposals and policy questions that the agency has sought comment on within the NPRM. In some instances, we have not included supporting rationale due to time limitations in compiling relevant data, coupled with the volume of questions and time limit for responding to the notice. However, it is important to note, as reflected in the main body of these comments, that we may provide additional supplemental information as we continue our review of the NPRM.

NHTSA NPRM: *"Consistent with GTR No. 13, NHTSA is proposing that FMVSS No. 308 be a vehicle-level standard, rather than an equipment standard…. NHTSA will monitor the deployment of hydrogen vehicles and how consumers are replacing parts of the fuel system. Since such data is lacking at this time, NHTSA is proposing FMVSS No. 308 as a vehicle standard, consistent with GTR No. 13. NHTSA will re-evaluate this decision based on comments received and on field data on hydrogen vehicle deployment, repair, and replacement parts. NHTSA seeks comment on whether FMVSS No. 308 should remain a vehicle standard, as well as whether FMVSS Nos. 307 and 308 should be combined into a single standard in the final rule."*

- **Auto Innovators Response #1:** We strongly disagree with the proposal to establish FMVSS No. 308 requirements as a vehicle-level standard as opposed to an equipment standard for the following reasons:

  - First, as noted previously, the development, manufacturing, and quality assurance of CHSS require specific knowledge and facilities. Therefore, many vehicle manufacturers will acquire the CHSS from independent suppliers for installation to their vehicles. In such a case, the vehicle manufacturer will rely on the supplier for ensuring the compliance of the CHSS to the standard. It is also likely that the same CHSS will be installed to vehicles of different vehicles manufacturers. Therefore, compliance responsibility should be assigned to the CHSS supplier.

  - Second, it is unclear how the proposed testing would be implemented in a practical way as the design and construction of the storage system is more applicable for the supplier of the storage system.

  - Third, it is important that replacement parts also meet the requirements of FMVSS to provide consistency.

  Auto Innovators supports NHTSA's proposal to limit the scope of any vehicle-level performance requirements established within regulation only apply to light-duty vehicles (≤ 10,000 lbs. GVWR). This is to help minimize test burden and address practical limitations in running full scale vehicle tests involving heavier vehicles.

FMVSS No. 308, "Compressed hydrogen storage system integrity"

NHTSA NPRM: "*NHTSA is proposing that FMVSS No. 308 only be a vehicle standard. As explained in more detail below, some of the proposed requirements are conditional on the vehicle type and characteristics. Without the knowledge of the relevant vehicle, some of the proposed CHSS standards cannot be tested. For these reasons, NHTSA does not intend that the proposed standard should extend to cover* *replacement parts, even though they would be considered motor vehicle equipment and still subject to NHTSA's safety defect authority, and replacement parts when installed may not take the vehicle out of compliance with the proposed new FMVSS No. 308, per 49 U.S.C. 30122. <u>NHTSA seeks comment on this approach.</u>"*

- **Auto Innovators Response #2:** For the reasons previously stated, Auto Innovators disagrees with this approach and requests that NHTSA establish an equipment standard as opposed to the proposed vehicle-level standard. We also disagree with the agency's intention not to extend the proposed standard to include replacement parts. This is important for ensuring the integrity of the CHSS should repairs be needed.

Compressed hydrogen storage system.

Hydrogen container.

NHTSA NPRM: *NHTSA's proposed definition for "container" would be "pressure-bearing component of a compressed hydrogen storage system that stores a continuous volume of hydrogen fuel in a single chamber or in multiple permanently interconnected chambers." These changes are intended to clarify the definition and provide greater regulatory certainty as to what is considered part of the container. The changes do not alter the substantive requirements. <u>NHTSA seeks comment on the proposed definition for the container.</u>*

- **Auto Innovators Response #3:** Auto Innovators disagrees with the agency's proposed definition for "container." We suggest that NHTSA instead harmonize with the definition in GTR No. 13, which, in our view, is well understood and provides sufficient regulatory clarity. To the extent that this does not alter the substantive requirements of the rule, there is no need to establish a new definition.

Closure devices.

NHTSA NPRM: *GTR No. 13 refers to closure devices as "primary" closure devices. This creates ambiguity about potential secondary or tertiary closure devices. As a result, NHTSA will refer simply to "closure devices." NHTSA therefore proposes to define the term "closure devices" as "the check valve(s), shut-off valve(s) and thermally activated pressure relief device(s) that control the flow of hydrogen into and/or out of a CHSS," so it will be clear what components are covered under the standard. <u>NHTSA seeks comment on removal of the word "primary" and on the proposed definition for "closure devices."</u>*

- **Auto Innovators Response #4:** Auto Innovators opposes the removal of the word primary as it is necessary to provide a distinction between "primary closure devices" and secondary and tertiary devices that may be present and outside the scope of this regulation. The term "primary closure device" in GTR No. 13 encompasses devices closest to the chamber, whether directly mounted in a single chamber or in a permanently connected multiple chamber system. This terminology implies attachment directly to any chamber or manifold. We recommend that the agency instead harmonize with GTR No. 13, which is again well understood and provides sufficient regulatory clarity.

NHTSA NPRM: *In GTR No. 13, the shut-off valve is defined as "a valve between the container and the vehicle fuel system that must default to the 'closed' position when not connected to a power source."*

NHTSA proposes adding the words "electrically activated" to the definition, so that a shut-off valve would be "an electrically activated valve between the container and the vehicle fuel system that must default to the 'closed' position when not connected to a power source." *<u>NHTSA seeks comment on the proposed definition of shut-off valve.</u>*

- **Auto Innovators Response #5:** We recommend that the agency harmonize with the definitions used in GTR No. 13.

NHTSA NPRM: *NHTSA proposes defining container attachments as "non-pressure bearing parts attached to the container that provide additional support and/or protection to the container and that may be removed only with the use of tools for the specific purpose of maintenance and/or inspection."* *<u>NHTSA seeks comment on the proposed definition of container attachments. In this definition, the word "temporarily" has been removed from the GTR definition because anything that can be removed temporarily can also be removed permanently.</u>* *For clarity, NHTSA has also shifted the order of some words relative to the definition in GTR No. 13.*

- **Auto Innovators Response #6:** While we recognize the agency's rationale for removing the word "temporary," the proposal to amend the definition from the current GTR No. 13 definition is largely unnecessary. For consistency, we recommend that the agency harmonize with GTR No. 13.

General requirements for the CHSS.

NHTSA NPRM: *The CHSS would be required to have an NWP of 70 MPa or less. This is because working pressures above 70 MPa are currently considered impractical and may pose a safety risk given current known technologies. The energy density of hydrogen does not increase significantly when pressurized above 70 MPa, so there is no significant improvement in hydrogen storage efficiency at pressures above 70 MPa. Pressures above 70 MPa, however, may present a greater safety hazard. As a result, NHTSA proposes that all CHSS must have an NWP less than or equal to 70 MPa.* *<u>NHTSA seeks comment on this requirement, and specifically asks commenters to identify any technologies that can safely store hydrogen at pressures above 70 MPa.</u>*

- **Auto Innovators Response #7:** Auto Innovators generally agrees with the agency's rationale regarding the NWP of known technologies; however, Auto Innovators requests that NHTSA put plan in place to enable the ability to react quickly to potential future technological developments. We recommend the agency align with GTR No. 13, where the qualification testing assumes 70MPa as highest NWP. It is inappropriate for the agency to specify anything higher.

NHTSA NPRM: *NHTSA tentatively concludes that it is not necessary to specify that closure devices be mounted directly on or within each container. NHTSA is also concerned that such a specification would be design restrictive. NHTSA is aware of CNG fuel systems where the closure devices are neither on nor within each container, and there have been no reported safety issues with such systems. Therefore, NHTSA is not proposing to include a requirement for closure devices to be on or within each container and would instead leave the location of closure devices to manufacturer discretion.* *<u>NHTSA seeks comment on requiring closure devices to be mounted directly on or within each container.</u>*

- **Auto Innovators Response #8:** Auto Innovators agrees with NHTSA in excluding a requirement to specify the mounting location of closure devices. Discussions in the Informal Working Group of GTR No. 13 Phase 2 suggested that the primary closure device should be mounted directly on the chamber for single-chamber systems, or on one of the chambers for permanently connected multiple-chamber systems. There was also discussion about attaching it directly to the manifold. However, for the development of CHSSs with non-traditional structures, such as conformable tanks, it is preferable to allow manufacturers discretion in positioning the closure device. Allowing for closure devices to be located elsewhere (but whose performance is confirmed by the fire test) gives manufacturers flexibility in design.

Performance requirements for the CHSS.

NHTSA NPRM: *It is NHTSA's understanding that BPO, associated with median or midpoint burst pressure for a batch of containers, can vary between batches of containers. Therefore, in order to facilitate compliance testing, NHTSA is proposing that manufacturers specify the BPO associated with each container on the required container label (discussed below). <u>NHTSA seeks comment on this labeling requirement, noting that it is not required by GTR No. 13.</u>*

- **Auto Innovators Response #9:** We disagree with the characterization that the BP0 can vary significantly between batches of containers. BP0 is a value specified by the manufacturer based on certain numbers of burst tests. Once BP0 is established, it is used for the sampling test in production quality control. In UNR134, the moving average of the last 10 test results must be "BP0 minus 10%" or above.

  Auto Innovators strongly recommends that the agency remain consistent with GTR No. 13 for the following reasons:

    - First, the agency has not explained or provided data regarding the benefit of having this value on the container itself. If BP0 cannot be obtained from the CHSS manufacturer during agency compliance testing, it may be assumed to be at least 200% NWP per GTR No. 13.

    - Second, there are currently no requirements for BP0 value to be on the label. Maintaining consistency with GTR No. 13 avoids creating unnecessary labeling requirement burdens.

    - Third, suppliers who provide these containers will supply test and certification beyond this BP0 value to the vehicle OEM, so the label BP0 has limited usefulness.

    - Fourth, these containers will not be sold separately to the end-user (hydrogen vehicle drivers or dealers). In addition, these end users are unlikely to understand BP0's significance, and at worst, could misinterpret the value. It's unclear what the value is for a customer to see it on the label.

  For these reasons, we do not support the inclusion of BP0 on the label. Additionally, such information (BP0) can be provided/confirmed by manufacturers prior to testing. It does not necessarily have to be on the container label.

Tests for baseline metrics.

NHTSA NPRM: *Consistent with GTR No. 13, the proposed tests for baseline metrics would include two tests for the container: the baseline initial burst pressure test to evaluate resistance to burst at high pressure, and the baseline initial pressure cycle test to ensure the container is designed to leak before burst and to evaluate its ability to withstand pressure cycling without burst and without leakage within its service life.*

- **Auto Innovators Response #10:** Auto Innovators supports the agency's proposal to harmonize with GTR No. 13.

Baseline initial burst pressure

NHTSA NPRM: *The requirement that the container tested must have a burst pressure within ±10 percent of BPO is based on the need to control variability in container production. If a manufacturing process produces containers with highly variable initial burst pressures, there is a possibility of a container with a dangerously low burst pressure. <u>NHTSA seeks comment on the safety need for specifying a limit on burst pressure variability in a batch and whether the 10 percent limit is appropriate; if commenters believe another limit is appropriate, they are asked to provide supporting data.</u>*

- **Auto Innovators Response #11:** Auto Innovators supports the agency's proposal to harmonize with GTR No. 13. During the discussions at the Informal Working Group for GTR No. 13 Phase 2, there were no objections to the BP0 ± 10% limit. We believe this limit is appropriate. Burst pressure variability can be controlled under each manufacturer's quality management system. Therefore, there is no need for it to be included in the regulatory text.

NHTSA NPRM: *In light of the variability in the minimum burst pressure and the need to meet the above two requirements at the end of the test for performance durability, NHTSA expects that manufacturers will ultimately design the container with an initial burst pressure well above 200 percent NWP. Accordingly, NHTSA believes that proposing BP_{min} to 200 percent NWP, as set forth in GTR No. 13 Phase 2, meets the need for safety. Proposing the BP_{min} to 200 percent NWP facilitates hydrogen vehicle development without unnecessary overdesign of components. <u>NHTSA seeks comment on the proposed BP_{min} of 200 percent NWP instead of the 225 percent NWP specified in GTR No. 13 Phase 1.</u>*

- **Auto Innovators Response #12:** Auto Innovators supports the agency's proposal to harmonize with GTR No. 13 and supports the agency specifying a BP_{min} of 200 percent. This provision reflects the consensus of the Informal Working Group of GTR No. 13 Phase 2, and we support this approach.

NHTSA NPRM: *In the case of containers having glass-fiber as a primary constituent, consistent with GTR No. 13 Phase 2, NHTSA is proposing a higher BP_{min} of 350 percent of NWP because these containers are highly susceptible to stress rupture as compared to carbon fiber containers. Stress rupture is a failure mode that relates to the intrinsic failure probability of the individual fibers that overwrap the container for support. This failure mode can occur when the fibers are held under stress for long periods of time (such as in a continuously pressurized container).48 The higher BP_{min} of 350 percent of NWP provides protection from the risk of stress rupture in containers having glass-fiber composite as a primary constituent. <u>NHTSA seeks comment on this proposed requirement and how NHTSA can determine if a</u>*

container has glass-fiber as a primary constituent. NHTSA seeks comment on appropriate criteria to determine the primary constituent in this context.

- **Auto Innovators Response #13:** Auto Innovators supports harmonization with GTR No. 13 and agrees with the agency's proposal for a higher BP_{min} of 350 percent of NWP for glass fibers.

NHTSA NPRM: *The test for performance durability, described below, includes a 1000 hour high-temperature (85 °C) static pressure test, which is designed to evaluate the container's resistance to stress rupture, in combination with other lifetime stress factors. Given that the high- temperature static pressure test is focused directly on evaluating stress rupture risk, and the test for performance durability represents an overall worst-case lifetime of stress factors, regardless of fiber type, NHTSA seeks comment on whether the baseline initial burst pressure test even needs to be included in the standard's requirements.*

- **Auto Innovators Response #14:** Auto Innovators recommends the agency harmonize with GTR No. 13, which establishes an initial baseline to compare to the residual burst pressure test value.[3]

NHTSA NPRM: *GTR No. 13 requires that the rate of pressurization be less than or equal to 1.4 MPa/s for pressures higher than 150 percent of the nominal working pressure. If the pressurization rate exceeds 0.35 MPa/s at pressures higher than 150 percent NWP, GTR No. 13 also requires that either the container is placed in series between the pressure source and the pressure measurement device, or that the time at the pressure above a target burst pressure exceeds 5 seconds… NHTSA is concerned that the second option that the time at the pressure above the target burst pressure exceeds 5 seconds is unclear and difficult to enforce. For example, it is not clear what pressure the "target burst pressure" is referring to since the pressure may be increasing continuously. Therefore, this option is not being proposed as an alternative and the container will simply be placed in series between the pressure source and the pressure measurement device. NHTSA seeks comment on this decision.*

- **Auto Innovators Response #15:** Auto Innovators disagrees with the agency's proposal. It is not practical for all designs to have containers placed in series between pressure source and pressure measurement device. An alternative method must be provided to perform testing to allow for different container designs. Potential pressure pulsations are also rather small-to-moderate compared to the absolute pressure level. We support keeping the 5 second specifications consistent with GTR No. 13.

Service life and number of cycles for the baseline initial pressure cycle test for containers on light and heavy vehicles.

NHTSA NPRM: *NHTSA seeks comment on the proposed number of cycles in Table-2. NHTSA seeks any additional data available related to vehicle life, lifetime miles travelled, and number of lifetime fuel cycles.*

- **Auto Innovators Response #16:** Auto Innovators supports the approach outlined in Table-2. It is more straightforward to define "the number of cycles for which the container leaks without burst or does not leak nor burst" as twice the "number of cycles representing the maximum

[3] GTR No. 13 – Section 5.1.2.1

service life for which the container does not leak nor burst." In other words, specifying 15,000 cycles for LDVs and 22,000 cycles for HDVs is sufficient.

Details of the baseline initial cycle test for containers on light and heavy vehicles.

NHTSA NPRM: *The low pressure during each cycle has been set at between 1 MPa to 2 MPa. This is selected to make the test easy to conduct. <u>NHTSA seeks comment on whether this low-pressure range is sufficiently wide for test lab efficiency.</u> The high pressure of 125 percent NWP is selected because this is the peak pressure that typically occurs during fueling. Furthermore, this is the high pressure used in the ANSI NGV 2-2007, Compressed Natural Gas Vehicle Fuel Containers, ambient cycling test.*

- **Auto Innovators Response #17:** Auto Innovators recommends NHTSA ensure an approach consistent with GTR No. 13, which allows for low pressure during each cycle at 2MPa +/- 1MPa.

NHTSA NPRM: "*Changing the hydraulic cycling profile does not change the stringency of the test or the safety of the container. However, the cycling profile can be important because testing NHTSA conducted resulted in a container failure attributed to a rapid defueling profile that was not representative of defueling rates during normal use. <u>NHTSA seeks comment on cycling profiles and whether the pressure cycling profile will significantly affect the test result</u>. <u>NHTSA seeks comment on more specifics of what manufacturers should be allowed to specify regarding an appropriate pressure cycling profile for testing their system.</u>*

Auto Innovators Response #18: Auto Innovators agrees that the cycle rate and cycling profile can affect container performance. Manufacturers should be allowed to specify cycle rate, max pressurization/depressurization rate, and cycle profile as these can result in failures that are not representative of conditions in service. Specifying minimum cycle rate may be appropriate to ensure testing can be performed in a reasonable period. However, as containers increase in size, test facilities' capabilities to cycle at a minimum rate may be impacted. More specifically, NHTSA should consider testing be performed as specified in GTR No. 13 Phase 2 (i.e. ≤ 10 cycles per minute).

Test for performance durability.

Proof pressure test.

NHTSA NPRM: "*Proof pressure test GTR No. 13 states that a container that has undergone a proof pressure test in manufacture is exempt from this test. However, NHTSA may not know whether a container has undergone the proof pressure test. As a result, NHTSA proposes that all containers will be subjected to the proof pressure test as part of the test for performance durability. In the event that a proof pressure test is conducted during manufacture and as part of the tests for performance durability, the container would experience two proof pressure tests. However, it is not expected that a second application will result in significantly more stress to the container than a single proof pressure test. <u>NHTSA seeks comment on conducting the proof pressure test on all containers</u>.*

- **Auto Innovators Response #19:** Auto Innovators disagrees with the agency's proposal as this will add unnecessary burden with no additional safety benefit. Proof pressure testing is already a requirement for all containers prior to entering service. A second NHTSA test is therefore unnecessary; in addition, testing a container that has already been subject to a manufacturer proof pressure test could adversely affect test results. We therefore request that the requirement be harmonized with GTR No. 13 Phase 2, which provides an exemption of the container that has undergone a proof pressure test as part of the prior manufacturing process.

Drop test.

NHTSA NPRM: "*The drop test is conducted to simulate dropping the container during handling or installation. Consistent with GTR No. 13, the unpressurized container may be dropped in any one of several orientations such as horizontal, vertical, or at a 45° angle. In the case of a non-cylindrical or asymmetric container, the horizontal and vertical axes may not be clear. In such cases, the container will be oriented using its center of gravity and the center of any of its shut-off valve interface locations. The two points will be aligned horizontally (i.e., perpendicular to gravity), vertically (i.e., parallel to gravity) or at a 45° angle relative to vertical. The center of gravity of an asymmetric container may not be easily identifiable, so NHTSA seeks comment on the appropriateness of using the center of gravity as a reference point for this compliance test and how to properly determine the center of gravity for a highly asymmetric container.*

- **Auto Innovators Response #20:** We support NHTSA's proposal to harmonize with GTR No. 13. For asymmetric containers, orientation can typically be identified when the container is mounted in the vehicle. Technical information about the center of gravity for asymmetric containers can also be provided to NHTSA upon request. We believe identifying the center of gravity of a container, even with an asymmetric shape, is not overly challenging. Hence, we advocate for maintaining the same regulations as GTR No.13 Phase 2, which we deem sufficient.

NHTSA NPRM: "*The drop test is a test in which container attachments may improve performance by protecting the container when it impacts the ground. Consistent with GTR No. 13, the drop test is conducted on the container with any associated container attachments. NHTSA seeks comment on including container attachments for the drop test.*

- **Auto Innovators Response #21:** Auto Innovators is opposed to NHTSA including container attachments in the drop test unless they are permanently attached to the container. That is, we support the removal of removable attachments during the drop test. This approach also provides flexibility to assess container robustness regardless of the container attachments. This is consistent with the intent of GTR No. 13, which states that "the [drop impact] test is designed to demonstrate that containers have the capability to survive representative pre-installation drop impacts."[4]

Surface damage test.

NHTSA NPRM: "*GTR No. 13 allowed all-metal containers to be exempt from the linear cuts because (1) metal is scratch resistant compared to non-metal, and (2) metal containers can be so thin that the cuts would fully penetrate the container. NHTSA's proposal includes this exemption, but NHTSA seeks comment on whether another objective and practicable procedure exists for evaluating surface abrasions that could apply to all containers, such as, for example, the application of a defined cutting force to the container surface.*

- **Auto Innovators Response #22:** We support the proposed exemption for metal containers. The procedure to apply a defined cutting force to the container surface is required of the container

[4] GTR No. 13 – Section 5.1.2.2

manufacturer which should provide enough technical information for compliance purposes. Similar to our comments above, requiring an additional test within regulation would simply add unnecessary burden.

NHTSA NPRM: "*NHTSA proposes that if the container attachments can be removed using a process specified by the manufacturer, they will be removed and not included for the surface damage test nor for the remaining portions of the test for performance durability. Testing the container without its container attachments is representative of a situation in which installation personnel remove the container attachments and fail to re-install them before the container enters service. Container attachments that cannot be removed are included for the test. NHTSA seeks comment on including container attachments for the surface damage test.*

Auto Innovators Response #23: Auto Innovators recommends harmonization with GTR No. 13 (i.e., if the container attachments can be removed using a process specified by the manufacturer, they should be removed. Any non-removable attachments should be included). Per GTR No. 13, this practice ensures the test is "conducted on the surface of the pressure bearing chamber of the container."

NHTSA NPRM: "*In accordance with GTR No. 13, NHTSA proposes specifying the pendulum impacts "on the side opposite from the saw cuts." For containers with multiple permanently interconnected chambers, GTR No. 13 specifies applying the pendulum impacts to a different chamber to that where the saw cuts were made. However, the agency is not proposing this distinction for pendulum impact location for containers with multiple permanently interconnected chambers because NHTSA is concerned that it may be less stringent (and thus, potentially less protective of safety) than when impacts are to the same chamber where the cuts were applied. NHTSA seeks comment on whether applying the impacts to the opposite side of the same chamber that received the saw cuts may be more stringent than applying the impacts to a separate chamber, and whether including the specification as written in GTR No. 13 would reduce stringency for containers with multiple permanently interconnected chambers relative to containers with a single chamber.*

- **Auto Innovators Response #24:** Auto Innovators supports adoption of the GTR No. 13 requirements. From an impact severity perspective, applying impacts on the same chamber does not make the test more stringent when compared to performing these on separate chambers.

Chemical exposure and ambient pressure cycling test.

NHTSA NPRM: "*The chemical exposure test is a test in which container attachments may improve performance by shielding the container from the chemical exposures. Container attachments will be included in the chemical exposure test unless they were removed prior to the surface damage test. NHTSA seeks comment on including container attachments for the chemical exposure test.*

- **Auto Innovators Response #25:** Auto Innovators supports harmonization of these requirements with GTR No. 13.[5] In other words, if the attachments can be removed, they should be removed prior to testing. If the attachments cannot be removed, then they should be included in the test.

[5] GTR No. 13 6.2.3.3 Figure 4 includes a Surface Damage Flow Chart to determine if and how the container attachments are included in the surface damage tests.

Similarly, if chemicals can get inside of container attachments or they are removable, then chemicals should be exposed to container surface.

High temperature static pressure test.

NHTSA NPRM: "*Consistent with GTR No. 13, the high temperature static pressure test involves holding the container for 1000 hours at 85 °C and 125 percent NWP.*

- **Auto Innovators Response #26:** Auto Innovators supports NHTSA's proposal to harmonize these requirements with GTR No. 13.

Extreme temperature pressure cycling test.

NHTSA NPRM: "*Consistent with GTR No. 13, the extreme temperature pressure cycling test involves pressure cycling at extreme temperatures and simulates operation (fueling and defueling) in extreme temperature conditions.*

- **Auto Innovators Response #27:** Auto Innovators supports NHTSA's proposal to harmonize these requirements with GTR No. 13.

Residual pressure test.

NHTSA NPRM: "*Consistent with GTR No. 3, the residual pressure test requires pressurizing the container to 180 percent NWP and holding this pressure for 4 minutes.*

- **Auto Innovators Response #28:** Auto Innovators supports NHTSA's proposal to harmonize these requirements with GTR No. 13.

Residual strength burst test.

NHTSA NPRM: "*Consistent with GTR No. 13, the residual strength burst test involves subjecting the end-of-life container to a burst test identical to the baseline initial burst pressure test. The burst pressure at the end of the durability test is required to be at least 80 percent of the BPO specified on the container label.*

- **Auto Innovators Response #29:** Auto Innovators agrees with the agency's proposal to harmonize the residual strength burst test with GTR. No. 13.

Test for expected on-road performance.

NHTSA NPRM: "*Consistent with GTR No. 13, the test for expected on-road performance uses on-road operating conditions including fueling and defueling the container at different ambient conditions with hydrogen gas at low and high temperatures. The test also includes a static high-pressure hold during which the CHSS is evaluated for hydrogen leakage and/or permeation of hydrogen from the CHSS. The container of the CHSS must withstand 180% NWP hold for 4 minutes and have a burst pressure that is at least 80 percent of its BPO at the end of the test for expected on-road performance. The test for expected on-road performance is closely consistent with the industry standard SAE J2579_201806… consistent with GTR No. 13, the test for expected on-road performance starts with a proof pressure test pressurizing the container with hydrogen to 150 percent NWP. This is followed by a total of 500 pressure cycles at various* *environmental conditions. The 500 cycles are broken up into stages for low temperature cycling, high temperature cycling, and ambient temperature cycling.*

- **Auto Innovators Response #30:** Auto Innovators supports NHTSA's proposal to harmonize these requirements with GTR No. 13.

Proof pressure test.

NHTSA NPRM: "*The proof pressure test is conducted in the same manner and for the same reasons discussed above for the test for performance durability.*

- **Auto Innovators Response #31:** Auto Innovators supports NHTSA's proposal to harmonize these requirements with GTR No. 13.

Ambient and extreme temperature gas pressure cycling test.

NHTSA NPRM: "See page 54-59 (of prepublication copy).

- **Auto Innovators Response #32:** Auto Innovators supports NHTSA's proposal to harmonize these requirements with GTR No. 13 where tests are conducted along with the temperature and/or pressure control devices in place, or where temperature and pressure parameters are strictly adhered to using equivalent measures.

Extreme temperature static gas pressure leak/permeation test.

NHTSA NPRM: "*Any hydrogen leakage and/or permeation from the CHSS cannot exceed the limit of 46 milliliter/hour (mL/h) per liter of CHSS water capacity. This limit is discussed below. The test may end before 500 hours if three consecutive hydrogen permeation rates separated by at least 12 hours are within 10 percent of the prior rate because this indicates a permeation steady state has been reached. <u>NHTSA seeks comment on how to accurately measure or otherwise determine the permeation rate from the CHSS.</u>*

- **Auto Innovators Response #33:** Auto Innovators recommends NHTSA adopt the gas permeation test defined in GTR No. 13.

NHTSA NPRM: "*In addition to the required leak/permeation limit discussed above, GTR No. 13 also includes a localized leak requirement. This requirement is based on the SAE technical paper 2008-01-0726, Flame Quenching Limits of Hydrogen Leaks… NHTSA is concerned that this requirement would not meet the Safety Act requirement for FMVSSs to be objective, due to the subjective estimation of bubble sizes. Therefore, the localized leak requirement has not been included in FMVSS No. 308. Furthermore, NHTSA believes that the primary safety risk of accumulating hydrogen is already addressed by the overall permeation limit of 46 mL/h/L-water-capacity. <u>NHTSA seeks comment on not including the localize leak requirement during the extreme temperature static gas pressure leak/permeation test. If commenters believe it should be included, NHTSA requests that they explain (1) how they believe it could be made more objective and (2) how specifically it would add to the standard's ability to meet the safety need.</u>*

- **Auto Innovators Response #34:** Auto Innovators agrees with the agency's decision to not include the localized leak test as part of the overall requirements.

Residual pressure test & residual strength burst test.

NHTSA NPRM: "*The residual pressure test and residual strength burst test are conducted in the same manner and for the same reasons discussed above for the test for performance durability.*

- **Auto Innovators Response #35:** Auto Innovators supports NHTSA's proposal to harmonize these requirements with GTR No. 13.

Test for service terminating performance in fire.

NHTSA NPRM: "*GTR No. 13 specifies a standardized calculation for burner area. NHTSA has considered the specification for HRR/A and determined that it could result in over-specification of the test parameters, potentially making it very difficult to conduct the test. In addition, NHTSA believes that the detailed temperature specifications for the pre-test container during the pre-test checkout are sufficient to ensure repeatability and reproducibility of the test. Therefore, NHTSA does not propose specifications for HRR/A. <u>NHTSA seeks comment on this decision.</u>*

- **Auto Innovators Response #36:** Auto Innovators disagrees with the agency's decision. The specifications in the GTR No. 13 pretest were to address concerns that initial round robin testing showed significant difference between labs. If a pretest cannot meet requirements within specified HRR/A then there is sufficient concern that the burner is significantly different from the performance expected to provide uniformity of test. The specifications in the GTR test procedure are objective, repeatable, and reproducible, and we recommend that the agency maintain consistency with this approach. If HRR/A is not used the amount of heat energy delivered during testing can vary and be inconsistent, affecting test results.

NHTSA NPRM: "*The three thermocouples along the bottom (labeled TBL25, TBC25, TBR25 in Figure-8) are considered burner monitor thermocouples. These thermocouples are positioned 25 mm below the pre-test container. Since these thermocouples are intended to monitor the burner, an alternative would be to position these thermocouples relative to the burner itself. <u>NHTSA seeks comment on whether it is preferable to position the burner monitor thermocouples relative to the pre-test container or relative to the burner.</u>*

- **Auto Innovators Response #37:** Auto Innovators recommends positioning the burner monitor thermocouples relative to the pre-test container to ensure that the temperatures measured on the pre-test container are representative. This approach would help ensure greater harmonization with GTR No. 13. In addition, in the IWG during discussion on GTR No.13 Phase 2, a concern on the potential failure of the thermocouples, used for burner monitoring, due to the possible expansion or failing of materials from the test article. In GTR No.13, there are some solutions on this to allow usage of additional thermocouple for back up and not to require monitoring once the required temperature is achieved (see Paragraphs 6.1.5.6.1, 6.2.5.7.2, and 6.2.5.7.3. of GTR No.13.).

NHTSA NPRM: "*The pre-test checkout is performed at least once before the commissioning of a new test site. Additionally, if the burner and test setup is modified to accommodate a test of different CHSS configurations than originally defined or serviced, then repeat of the pre-test checkout is needed prior to* *performing CHSS fire tests. <u>NHTSA seeks comment on the frequency of conducting this pre-test checkout for ensuring repeatability of the fire test on CHSS.</u>*

- **Auto Innovators Response #38:** We agree with NHTSA regarding the need for a repeat of the pre-test checkout if the burner or test setup is modified for different CHSS configurations. We recommend the pretest checkout is performed at the manufacturer's discretion if the burner setup has not been modified.

NHTSA NPRM: "*NHTSA's testing indicated that the airflow during the pre-test may be different from that of the CHSS if the pre-test container length is substantially different from that of the CHSS to be tested. The difference in air flow between the two tests could cause differences in fire input to the CHSS compared to the pre-test container. Therefore, NHTSA recommends that for CHSS of length between 600 mm and 1650 mm, the difference in the length of the pre-test container and the CHSS be no more than 200 mm. <u>NHTSA seeks comment on whether this recommendation should be a specification for the pre-test container.</u>*

- **Auto Innovators Response #39:** Auto Innovators disagree with the agency on the need to further specify the pre-test container. The use of the pre-test container is simply to verify the burner and has no direct relation to the test vessel size of the CHSS. We recommend the agency instead harmonize with GTR No. 13. In addition, paragraph 6.2.5.4.5.5. of GTR No.13 provides alternative pre-test conditions for testing large width/diameter CHSS (e.g. conformable containers). Due to the large surface of the test article to be exposed to the fire, the oxygen supply to the central area of the burner may become insufficient, resulting in a lower temperature than those obtained with standard pre-test containers, which the GTR helps to address.

NHTSA NPRM: "*NHTSA seeks comment on the requirement for $Tmin_{ENG}$. In particular, <u>NHTSA seeks comment on allowing for a wider variation than 50 °C below the pre-test temperatures. A variation of 50 °C is small in the context of fire temperatures, and such a small variation limit may make the test more difficult for test labs to conduct.</u>*

- **Auto Innovators Response #40:** The Agency should harmonize with GTR No. 13 Phase 2 and maintain the 50 °C variation requirement. Wider temperature variation would likely affect the test results and therefore affect CHSS design.

NHTSA NPRM: "*Furthermore, as currently specified, $Tmin_{LOC}$ and $Tmin_{ENG}$ would be time-dependent variables because they are based on a time-dependent rolling average. Having $Tmin_{LOC}$ and $Tmin_{ENG}$ being time-dependent is complex and would make the testing difficult to monitor. <u>NHTSA seeks comment on a simpler calculation for $Tmin_{LOC}$ and $Tmin_{ENG}$ that will result in constant values for $Tmin_{LOC}$ and $Tmin_{ENG}$.</u>*

- **Auto Innovators Response #41:** Auto Innovators requests the agency align with GTR No. 13 with respect to calculations for and definitions of $Tmin_{LOC}$ and $Tmin_{ENG}$.

NHTSA NPRM: "*GTR No. 13 specifies that this process is repeated until burner monitor thermocouple temperatures satisfy $Tmin_{LOC}$ and $Tmin_{ENG}$. NHTSA has considered this additional pre-test process and determined that it is unnecessary. The goal of the pre-test checkout is a repeatable and reproducible fire exposure among different testing facilities. NHTSA has determined there is no need for design-specific modification to the fire test procedure. Furthermore, the additional pre-test procedures add considerable* *complexity to the test procedure, and as a result could undermine the repeatability and reproducibility of the fire test. Therefore, NHTSA is not proposing these additional pre-test procedures. NHTSA seeks comment on this decision. If commenters believe that the additional pre-test procedures are necessary, NHTSA requests that they explain (1) how they would improve the safety outcome of the standard, and (2) how they would improve the repeatability and reproducibility of the fire test.*

- **Auto Innovators Response #42:** In general, we agree with NHTSA streamlining the criteria for pre-test procedures. However, additional clarification should be provided that a repeat test is only required if the if the pretest does not meet the specified requirements.

  The prescribed test temperatures are based on vehicle tests conducted by JARI and represents reasonably temperatures seen on the CHSS.[6] Not meeting the correct pretest temperatures could result in over testing or under testing of CHSS resulting in either a false pass or false failure of the CHSS. If only certain areas of an irregular CHSS are heated, the temperature of the CHSS may not rise to the necessary standard temperatures and there may be a negative influence on the activation of the TPRD.

  The intent of the pretest is to ensure uniformity of test between testing facilities and approximating test conditions as seen in vehicle fires. We therefore recommend following basic burner design as described in GTR No. 13 and maintaining HRR/A as intended to provide guidance for repeatability and reproducibility of test.

NHTSA NPRM: "*Flexibility is provided to adjust the length of the engulfing fire zone to match the CHSS length, up to a maximum of 1.65 m. This allows test laboratories to reduce burner fuel consumption when testing small containers. The width of the burner, however, is fixed at 500 mm for all fire tests, regardless of the width or diameter of the CHSS container to be tested, so that each CHSS is evaluated with the same fire condition regardless of size. The length of the localized fire zone is also fixed to 250 mm for all fire tests. An example of a typical burner is shown in Figure-10 and Figure-11 below. NHTSA seeks comment on a specification for the burner rail tubing shape and size, which can affect the spacing between the nozzle tips.*

- **Auto Innovators Response #43:** Auto Innovators recommends harmonizing with GTR No. 13. Industry standards have also established 1.65m as the length of the engulfing fire.

NHTSA NPRM: "*GTR No. 13 specifies that the CHSS is rotated relative to the localized burner to minimize the ability for TPRDs to sense the fire and respond. GTR No. 13 specifies establishing a worst-case based on the specific CHSS design. However, NHTSA is concerned that establishing a worst-case based on a specific design may be subjective. NHTSA instead proposes that the CHSS is positioned for the localized fire by orienting the CHSS relative to the localized burner such that the distance from the center of the localized fire exposure to the TPRD(s) and TPRD sense point(s) is at or near maximum. This provides a challenging condition where the TPRD(s) may not sense the localized fire. The engulfing fire zone includes the localized fire zone and extends along the complete length of the container, in one direction, towards the nearest TPRD or TPRD sense point, up to a maximum burner length of 1.65 m. Some examples of*

[6] GTR13 Part 1, paragraphs 86 through 113

possible burner orientations are shown in Figure-12 and Figure-13. <u>NHTSA seeks comment on the proposed orientation of the CHSS relative to the localized burner.</u>

- **Auto Innovators Response #44:** We agree with NHTSA on the need to address subjectivity in how the "worst-case" is defined, however, this issue is already addressed in GTR No. 13, with clear instruction for how this condition is identified. While the agency proposes an approach that may represent a "challenging condition," it may not always be considered the worst case.

NHTSA NPRM: *In order to minimize hazard, jet flames occurring anywhere other than a TPRD outlet, such as the container walls or joints, cannot exceed 0.5 meters in length. <u>NHTSA seeks comment on how to accurately measure jet flames.</u>*

- **Auto Innovators Response #45:** Auto Innovators recommends NHTSA use camera systems and other similar imaging devices (e.g., infrared) to identify the length of jet flames during testing.

Tests for performance durability of closure devices.

NHTSA NPRM: "*The tests for performance durability of closure devices carry a significant test burden. To evaluate a single shut-off valve or check valve, 8 units are required for a total of 17 individual tests. <u>While NHTSA is proposing these requirements to be consistent with GTR No. 13, NHTSA seeks comment on whether testing of this extent is necessary to meet the need for safety, or whether it is still possible to meet the need for safety with a less-burdensome test approach or with a subset of the test for performance durability of closure devices</u>. <u>If commenters believe another approach or subset of tests is appropriate and meets the need for safety, NHTSA requests that commenters provide specific detail on (1) the alternate approach or subset of tests and (2) how it meets the need for safety adequately</u>.*

Auto Innovators Response #46: We agree with NHTSA's proposal to remain consistent with the requirements of GTR No. 13 for the test performance and durability of closure devices.

NHTSA NPRM: "*FMVSS No. 308 will only require hydrogen with a purity of at least 99.97 percent, less than or equal to 5 parts per million of water, and less or equal to 1 part per million particulate. <u>NHTSA seeks comment on any other impurities that could affect the results of the tests for performance durability of closure devices</u>.*

- **Auto Innovators Response #47:** The stated levels of impurity are important for CHSS. Other impurities are addressed or limited through hydrogen quality specifications (e.g. SAE J2719) due to fuel stack performance and durability.[7]

NHTSA NPRM: "*Using a non-reactive gas for testing would have the benefit of reducing the test lab safety risk related to handling pressurized hydrogen. However, it is not clear if replacing hydrogen with a non-reactive gas reduces stringency and therefore may not adequately address the safety need. As a result, this option has not been proposed in FMVSS No. 308. <u>NHTSA seeks comment on whether testing with a non-reactive gas instead of hydrogen reduces test stringency</u>. <u>If commenters believe (and can</u>*

[7] SAE J2719_202003

explain) that it does not reduce test stringency, NHTSA requests that they identify a suitable non-reactive gas to replace hydrogen, such as helium or nitrogen, and explain why it is suitable.

- **Auto Innovators Response #48:** Auto Innovators suggests that NHTSA remain consistent with the requirements of GTR No. 13 and specify testing with hydrogen, helium, or a non-reactive gas mixture containing a detectable amount of helium gas (see GTR No. 13 S.6.2.6). Testing with a non-reactive gas should be acceptable as long as the test conditions (pressure level and number of cycles required) are the same as when testing with hydrogen.

TRPD.

NHTSA NPRM: "*GTR No. 13 does not consider the possibility of the TPRD activating during the pressure cycling test, temperature cycling test, salt corrosion test, vehicle environment test, stress corrosion cracking test, drop and vibration test, or leak test. The temperatures applied during these tests are not characteristic of fire and therefore should not cause the TPRD to activate. TPRD activation in the absence of temperatures characteristic of a fire indicates that the TPRD is not functioning as intended and presents a safety risk due to the hazards associated with TPRD discharge. As a result, NHTSA is proposing that if the TPRD activates at any point during the pressure cycling test, temperature cycling test, salt corrosion test, vehicle environment test, stress corrosion cracking test, drop and vibration test, or leak test, that TPRD will be considered to have failed the test. NHTSA seeks comment on this proposed requirement.*

- **Auto Innovators Response #49:** Auto Innovators agrees with the agency proposal to integrate the TPRD failure assessment as when evaluating other aspects of performance.

Pressure cycling test.

NHTSA NPRM: "*Similar to the CHSS test for expected on-road performance, the pressure cycling test would evaluate a TPRD's ability to withstand repeated pressurization and depressurization. One TPRD unit undergoes 15,000 internal pressure cycles with hydrogen gas. While the proposed 15,000 pressure cycles for the TPRD is consistent with GTR No. 13, NHTSA notes that this number of cycles is higher than the maximum 11,000 pressure cycles applied to containers. NHTSA seeks comment on the need for 15,000 pressure cycles for TPRDs. The testing is performed under the conditions shown in Table-9 with a maximum cycling rate of 10 cycles per minute… NHTSA [also] seeks comment on the number of TPRD pressure cycles.*

- **Auto Innovators Response #50:** We recommend NHTSA remain consistent with the requirements of GTR No. 13. The 15,000-cycle requirement in GTR No. 13 is harmonized with other industrial standards**.**

Accelerated life test.

NHTSA NPRM: "*The unit tested at T_f must activate in less than 10 hours and the unit tested at TL must not activate in less than 500 hours. The required 500 hours without activation demonstrates the unit's resistance to creep.*

- **Auto Innovators Response #51:** We recommend NHTSA remain consistent with the requirements of GTR No. 13.

Temperature cycling test.

NHTSA NPRM: "*Only the low-temperature condition leak test is conducted after the temperature cycling test because leaks are most likely to occur at low temperatures.*

- **Auto Innovators Response #52:** We recommend NHTSA remain consistent with the requirements of GTR No. 13.

Salt corrosion resistance test.

NHTSA NPRM: "*After the salt corrosion exposure, the TPRD units are subjected to the Leak Test, Benchtop Activation Test, and Flow Rate Test. These tests, discussed below, verify the essential functions of the TPRD. NHTSA seeks comment on the clarity and objectivity of the salt corrosion resistance test procedure. If commenters have suggestions on how to change the salt corrosion resistance test procedure, NHTSA asks that they please explain how their suggested changes improve the clarity and objectivity, and how they continue to meet the need for safety represented by this test.*

- **Auto Innovators Response #53:** We recommend NHTSA remain consistent with the requirements of GTR No. 13.

Vehicle environment test.

NHTSA NPRM: "*After the conclusion of the exposures, the TPRD unit is subjected to the Leak Test, Benchtop Activation Test, and Flow Rate Test. These tests, discussed below, verify the essential functions of the TPRD. In addition to these subsequent tests, the TPRD must not show signs of cracking, softening, or swelling. GTR No. 13 further specifies that "cosmetic changes such as pitting or staining are not considered failures." NHTSA seeks comment on including this specification, and notes that pitting can be an aggressive form of corrosion which can ultimately lead to component failure due to cracking at the pitting site.*

- **Auto Innovators Response #54:** The Agency should harmonize with GTR No. 13 Phase 2, which specifies that "cosmetic changes such as pitting or staining are not considered failures".[8]

Stress corrosion cracking test.

NHTSA NPRM: "*The chamber is maintained at atmospheric pressure and 35 °C. This simulates a slightly elevated temperature. In GTR No. 13, the only requirement to pass the stress corrosion cracking test is that the components must not exhibit cracking or delaminating due to this test. NHTSA seeks comment on this performance requirement and whether there are alternative requirements for this test beyond basic visual inspection, such as subjecting the TPRD to the leak test.*

- **Auto Innovators Response #55:** Material requirements for hydrogen usage are well established in industry standards. Additionally, Part I of GTR No. 13 Phase 2 outlines test methods for "M. Materials Evaluation for Hydrogen Service" and "N. Humid Gas Stress Corrosion Cracking Testing for Aluminum Alloys," which we recommend NHTSA reference as part of this rulemaking.[9] However, if NHTSA finds that material regulations cannot be adopted because they are not performance requirements, alternative measures should be considered.

[8] GTR No. 13, paragraph 6.2.6.1.5.

[9] Per GTR No. 13 Phase 2, this test would only apply when TPRDs contain copper alloys.

Leak test.

NHTSA NPRM: "*At the ambient and high temperature tests, the TPRD is evaluated for leaks at 2 MPa and 125 percent NWP. The test pressure of 125 percent NWP represents the peak pressure that typically occurs during fueling. For the low temperature test, however, the maximum pressure is reduced to 100 percent NWP because maximum fueling pressure is lower in extremely cold environments. <u>NHTSA seeks comment on the need to perform the leak test at 2 MPa in addition to the higher pressures.</u>*

- **Auto Innovators Response #56:** Auto Innovators agree with harmonizing the requirements with GTR No. 13 as it is important to evaluate seal performance under both low- and high-pressure conditions, as well as low temperatures.

Benchtop activation test.

NHTSA NPRM: "*GTR No. 13 does not provide any information on how to proceed in the event that a TPRD does not activate at all during the benchtop activation test. A TPRD that does not activate when inserted into the oven or chimney is not functioning as intended and therefore presents a safety risk. As a result, <u>NHTSA is proposing that if a TPRD does not activate within 120 minutes from the time of insertion into the oven or chimney, the TPRD is considered to have failed the test. The time limit of 120 minutes is selected based on the maximum possible duration of the CHSS fire test.</u> <u>NHTSA seeks comment on this requirement.</u>*

- **Auto Innovators Response #57:** Auto Innovators agree with the agency's proposal regarding the TPRD failure assessment in situations where it fails to activate during the specified time period.

Flow rate test.

NHTSA NPRM: "*The number of significant figures used in the measurement of flow rate can impact the test result. For example, a test flow rate of 1.7 flow units compared against a baseline flow rate of 2.0 flow units does not meet the requirement. However, in this case, if flow rate were measured using only one significant figure, the two flow rates would be identical (2 flow units). As a result, <u>NHTSA proposes requiring that the flow rate be measured in units of kilograms per minute with a precision of at least 2 significant digits. NHTSA seeks comment on this proposed requirement.</u>*

- **Auto Innovators Response #58:** We agree with NHTSA on the proposed flow rate measurement units and level of precision.

Atmospheric exposure test.

NHTSA NPRM: "*NHTSA is concerned that this test is not objectively enforceable because the requirement involves a subjective determination of evidence of deterioration. Furthermore, the test would require NHTSA to determine which components are non-metallic, exposed to the atmosphere, and provide a fuel-containing seal. As a result, <u>this test has not been included in FMVSS No. 308. NHTSA seeks comment on not including the atmospheric exposure test</u>.*

- **Auto Innovators Response #59:** Auto Innovators supports the agency not including this test for the reasons stated by the agency in the request for comment above.

Hydrostatic strength test.

NHTSA NPRM: "*In the event of a leak, it may become impossible for the test laboratory to increase pressure on the valve. This occurs when any increase in applied pressure is offset by leakage flow, thereby negating the pressure increase. If this occurs, it is not possible to complete testing. To address this issue, NHTSA is proposing that valves shall not leak during the hydrostatic strength test, and that a leak would constitute a test failure. <u>NHTSA seeks comment on the requirement that valves not leak during the hydrostatic strength test</u>.*

- **Auto Innovators Response #60:** Auto Innovators agrees with NHTSA on its proposal to require that valves do not leak during the hydrostatic strength test.

Extreme temperature pressure cycling test.

NHTSA NPRM: "*The total number of operational cycles is 15,000 for the check valve, consistent with the 15,000 cycles used for the TPRD above. The total number of operational cycles is 50,000 for the shut-off valve. The higher 50,000 cycles for the shut-off valve reflects the multiple pressure pulses the shut-off valve experiences as it opens and closes repeatedly during service. In contrast, the check valve only experiences a pressure pulse during fueling. <u>NHTSA seeks comment on the number of pressure cycles for check valves and shut-off valves</u>.*

- **Auto Innovators Response #61:** Auto Innovators recommends that NHTSA remain consistent with GTR No. 13.

NHTSA NPRM: "*After cycling, each valve is subjected to 24 hours of "chatter flow" to simulate the chatter condition described above. Chatter flow means the application of a flow rate of gas through the valve that results in chatter as described above. NHTSA is concerned, however, that the application of chatter flow could be partially subjective. <u>NHTSA seeks comment on the following aspects of the chatter flow test</u>:*

- **Auto Innovators Response #62a-f:**
  a. Appropriate methodology or a procedure for inducing chatter flow.
     - Response: Chatter may be measured by downstream pressure fluctuation, valve body vibration, or audible levels.
  b. Appropriate instrumentation and criteria to measure and quantify chatter flow such as a
     - Response: No comments.
  c. decibel meter and minimum sound pressure level.
     - Response: No comments
  d. How to proceed in cases where no chatter occurs.
     - Response: If no chatter occurs, the system should be deemed to have passed this aspect of performance test requirements.
  e. The specific safety risks that are addressed by the chatter flow test.
     - Response: Chatter is a known issue for check valves and can result in leakage or loss of function.
  f. The possibility of not including the chatter flow test.
     - Response: Chatter is required to verify leak free function of valve post chatter test conditions.

Salt corrosion resistance test.

NHTSA NPRM: "*The salt corrosion resistance test is conducted in the same manner and for the same reasons discussed above for TPRDs.*

- **Auto Innovators Response #63:** Auto Innovators recommends that NHTSA remain consistent with GTR No. 13.

Vehicle environment test.

NHTSA NPRM: "*The vehicle environment test is conducted in the same manner and for the same reasons discussed above for TPRDs.*

- **Auto Innovators Response #64:** Auto Innovators recommends that NHTSA remain consistent with GTR No. 13.

Atmospheric exposure test.

NHTSA NPRM: "*GTR No. 13 includes an atmospheric exposure test for check valves and shut-off valves identical to the atmospheric exposure test for TPRDs. However, this test has not been included for check valves and shut-off valves for the same reasons it was not included for TPRDs. NHTSA seeks comment on not including the atmospheric exposure test for check valves and shut-off valves.*

- **Auto Innovators Response #65:** Auto Innovators supports the agency not including this test for the reasons stated by the agency in the request for comment above.

Electrical tests.

NHTSA NPRM: "*The test for electrical insulation is conducted by applying 1000 V between the power conductor and the component casing for at least two seconds, consistent with the industry standards NGV 3.1-2012 and HGV 3.1-2022… The isolation resistance between the valve and the casing must be 240 kΩ or more. This represents a high level of resistance to prevent the valve casing from being energized in the event the power conductor short circuits within the valve. Some valves may have requirements specified by their manufacturers for peak and hold pulse width modulation duty cycle. NHTSA seeks comment on whether and how to adjust the proposed test procedure to account for a manufacturer's specified peak and hold pulse width modulation duty cycle requirements.*

- **Auto Innovators Response #66:** Additional information is needed to understand the agency's intent. Testing is to verify insulation resistance between a single conductor and component casing. Operation of valve has no bearing on insulation resistance, regardless of whether it is peak and hold modulation or saturated current.

Vibration test.

NHTSA NPRM: "*This test is conducted with the valve pressurized to 100 percent NWP to simulate vibrations occurring while the valve is in service. After vibration, the valve shall comply with the leak test and the hydrostatic strength test to verify it retains its basic ability to contain hydrogen and resist burst due to over-pressurization. GTR No. 13 also contains a requirement that "each sample shall not show visible exterior damage that indicates that the performance of the part is compromised." Showing signs of damage is a subjective measure and lacks the objectivity needed per the Motor Vehicle Safety Act. Therefore, this language has been removed.* ***Do you have any concerns with this proposal****?*

- **Auto Innovators Response #67:** We agree with the agency's assessment regarding the lack of an objective measure of performance for evaluating vibrations.

Stress corrosion cracking test.

NHTSA NPRM: "*The stress corrosion cracking test is conducted in the same manner and for the same reasons discussed above for TPRDs.*

- **Auto Innovators Response #68:** Auto Innovators agrees with NHTSA's proposal to remain consistent with GTR No. 13.

Labeling requirements.

NHTSA NPRM: "*NHTSA tentatively concludes that the container label(s) include the following information:*

- *Manufacturer, serial number, date of manufacture*
- *The statement "Compressed Hydrogen Only."*
- *The container's NWP in MPa and pounds per square inch (psi).*
- *Date when the system should be removed from service.*
- *BPO in MPa and psi."*

- **Auto Innovators Response #69:** Auto Innovators disagrees with the proposed labeling requirement to include BP0 as it adds duplicative and unnecessary burden for no apparent safety benefit. As stated in response #9, we do not agree with requiring BP0 on container labels. The initial burst pressure (BP0) must be 200% NWP or higher to ensure safety. Displaying BP0 on the label is unnecessary and could cause confusion, as users are unlikely to understand its significance. Auto Innovators proposes the label requirements be harmonized with GTR No. 13.

FMVSS No. 307, "Fuel system integrity of hydrogen vehicles"

NHTSA NPRM: "*FMVSS No. 307 would set requirements for the vehicle fuel system to mitigate hazards associated with hydrogen leakage and discharge from the fuel system, as well as requirements to ensure hydrogen leakage, hydrogen concentration in enclosed spaces of the vehicle, and hydrogen container displacement are within safe limits post-crash. A hydrogen fuel system includes the fueling receptacle, CHSS, fuel cell system or internal combustion engine, exhaust systems, and the fuel lines that connect these systems.*

- **Auto Innovators Response #70:** Auto Innovators agrees with NHTSA's proposal to remain consistent with GTR No. 13.

NHTSA NPRM: "*Table-10 lists the requirements for the hydrogen fuel system to be incorporated in FMVSS No. 307, which includes separate sections for normal vehicle operations and post-crash requirements. The fuel system integrity requirements for normal vehicle operations would apply to all hydrogen-fueled vehicles, while the post-crash fuel system integrity requirements only apply to light vehicles. <u>NHTSA seeks comment on the application of FMVSS No. 307 to all vehicles, including heavy vehicles (vehicles with a GVWR greater than 4,536 kg (10,000 pounds).</u>*

- **Auto Innovators Response #71:** The safety and integrity of hydrogen vehicles is a priority regardless of vehicle size. However, based on the research and supporting information provided in the NPRM, Auto Innovators does not support the inclusion of heavy vehicles in FMVSS 307 at this time. The potential design implications for heavy vehicles, which have not previously been subject to these regulatory requirements, require a more 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 these vehicles. Similar to the comments Auto Innovators provided in response to the NPRM on FMVSS 305a, we recommend that 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.

Fuel system integrity during normal vehicle operations.

Fueling receptacles.

NHTSA NPRM: "*This proposal includes five performance requirements for the hydrogen fueling receptacle. These requirements ensure safe use and proper function of the receptacle. If hydrogen is not properly contained by the fueling receptacle, hydrogen may escape into the surrounding environment where it may accumulate and become ignited, leading to an explosion or fire… The assessment for all five receptacle requirements is by visual inspection. NHTSA seeks comment on these proposed requirements for the fueling receptacle and on the objectivity of assessment by visual inspection.*

- **Auto Innovators Response #72:** The requirement that "a compressed hydrogen fueling receptacle shall prevent reverse flow to the atmosphere" appears to have no reference test. Auto Innovators recommends harmonization to the GTR No. 13 test S6.2.6.2.2. We also request that the agency provide clarification on the required label location as we have concerns with the additional language that is proposed compared to GTR No. 13.

Over-pressure protection for low-pressure system.

NHTSA NPRM: "*NHTSA is proposing to adopt GTR No. 13's requirement of over-pressure protection for low-pressure systems. Accordingly, the agency proposes requiring countermeasures to prevent failure of downstream components in the event a pressure regulator fails to properly reduce the fuel pressure from the much higher pressure in the CHSS. The activation pressure of the overpressure protection device would be lower than or equal to the maximum allowable working pressure for the appropriate section of the hydrogen system as determined by the manufacturer. NHTSA seeks comment on the requirement for an overpressure protection device in the fuel system and how to test the performance of such a device.*

- **Auto Innovators Response #73:** We recommend that NHTSA align with GTR No. 13 and not require an additional test. The main areas of the GTR No. 13 are: (1) CHSS, high-pressure closures, PRD, and fuel lines; (2) Electrical safety; (3) Performance and other requirements for subsystem requirements in the vehicle.[10] The overpressure protection NHTSA is proposing is part of the "Hydrogen Delivery" system of a HFCV, which should be outside the scope this

[10] See GTR No.13 Amend 1, B. Scope of work for Phase 1 and Phase 2

regulation.[11] Although low-pressure systems are outside the scope of GTR No. 13, overpressure protection for these systems is clearly defined as: "The hydrogen system downstream of a pressure regulator shall be protected against overpressure due to the possible failure of the pressure regulator." Each OEM will verify this. Therefore, we believe there is no need to add this requirement to FMVSS 307.

Hydrogen discharge system.

NHTSA NPRM: "*We are proposing several requirements from GTR No. 13 related to the TPRD vent discharge direction. The primary purpose of these requirements is to prevent additional safety hazards due to hydrogen discharge from the TPRD that could compromise other vehicle components and/or inhibit the ability of passengers to safely exit the vehicle… In addition to these requirements from GTR No. 13, we believe an additional requirement is necessary to protect potential occupants attempting to exit the vehicle or first responders approaching the vehicle. We are proposing that hydrogen vented through the TPRD(s) be directed upwards within 20° of vertical relative to the level surface or downwards within 45° of vertical relative to the level surface. This requirement would prevent the TPRD discharge from being directed horizontally, which would create a hazard to persons exiting the vehicle and/or to first responders approaching the vehicle. NHTSA seeks comment on this additional requirement for TPRD discharge direction, and on the proposed discharge angles.*

- **Auto Innovators Response #74:** We do not support the TPRD vent discharge direction requirements as proposed in S5.1.3.1(b). Extensive discussions within the Informal Working Group of GTR No. 13 Phase 2 highlighted the complexities and variations in vehicle structure, particularly for HDVs, that influence the optimal direction for TPRD vent exhaust. The group concluded that a one-size-fits-all requirement is not feasible due to these structural differences. Consequently, we cannot agree with the proposed additional requirement specifying the discharge direction from the TPRD vent. This requirement lacks the flexibility needed to accommodate diverse vehicle designs and may impose unnecessary constraints on manufacturers. This issue was discussed extensively in the GTR process. Due to the various CHSS configurations and location on the vehicle, the decision was the specification of angles was too prescriptive and potentially design restrictive. Instead, manufacturers are appropriately directed to ensure their design should NOT point to the TPRD. This allows for more flexible designs, without degradation to safety. We also propose to delete S5.1.3.1(c) (5) and (6) because these are not harmonized with GTR No. 13, and the intent is not clear considering the proposed requirement of S5.1.3.1(b).

Vehicle exhaust system.

NHTSA NPRM: "*NHTSA is proposing to adopt GTR No. 13's vehicle exhaust system requirements… NHTSA is proposing adopting the test requirement outlined in GTR No. 13. The test procedure would be conducted after the vehicle has been set to the "on" or "run" position for at least five minutes prior to testing.*

[11] See Fig 1 of GTR No.13 Amend1

- **Auto Innovators Response #75:** We support NHTSA's proposal to harmonize the vehicle exhaust system requirements with GTR No. 13, though instead of specifying "on" or "run" position, the agency should use terminology and test conditions per that standard.[12]

Fuel system leakage.

NHTSA NPRM: "*NHTSA is proposing that the fuel system leakage requirement for no leakage apply to the entire hydrogen fuel system downstream of the shut-off valve, which includes the fuel lines and the fuel cell system. NHTSA is further proposing to define fuel lines to include all piping, tubing, joints, and any components such as flow controllers, valves, heat exchangers, and pressure regulators. From a safety standpoint, there is no difference between a leak coming from fuel line piping, and a leak coming from a valve, pressure regulator, or the fuel cell system itself. <u>While NHTSA is proposing a strict no leakage standard, we are seeking comment on whether there is a safe level of hydrogen that may leak, and if so, what would be an objective leakage limit and how to accurately quantify hydrogen leakage from the fuel system.</u>*

- **Auto Innovators Response #76:** We disagree with the agency's proposal of a strict no leakage requirement for light-duty vehicles. Using sensitive equipment, leakage can be measured to less than 10^{-10} Pa m^3/s, well below hazardous leak levels. The allowable leakage rate should be consistent with single point leakage as defined in GTR No. 13.

NHTSA NPRM: "*NHTSA is proposing to test this requirement using either a gas leak detector or leak detecting liquid (bubble test). NHTSA seeks comment if one of these tests is preferrable. NHTSA is also proposing that the test would be conducted with the fuel system at NWP after having been in the "on" or "run" position for at least five minutes. We believe these conditions produce an elevated likelihood of leakage. <u>We seek comment on whether alternative conditions would better simulate realistic scenarios when downstream lines are more likely to leak</u>.*

- **Auto Innovators Response #77:** We support the agency's proposal, though instead of specifying the "on" or "run" position, the agency should use terminology and test conditions per GTR No. 13.[13]

Protection against flammable conditions

NHTSA NPRM: "*<u>NHTSA seeks comment on requiring built-in hydrogen concentration detectors and seeks comment on the reliability of the required warning and shut-off valve closure for vehicles that do not have built-in hydrogen concentration detectors</u>.*

- **Auto Innovators Response #78:** We do not support that "enclosed or semi-enclosed spaces" be defined differently from GTR No. 13, particularly for inclusion of the "space under the hood."

Warning for Elevated Hydrogen Concentration.

NHTSA NPRM: "*The proposed test procedures in this section [f] would be conducted without the influence of any wind. <u>NHTSA seeks comment on providing more specific wind protection requirements</u>*

---

[12] Per GTR No. 13 Amend1, section 6.1.3.1.1.1, "the propulsion system of the test vehicle is started, warmed up to its normal operating temperature, and left operating for the test duration."

[13] Ibid.

and seeks comment on limiting the maximum wind velocity during testing to 2.24 meters/second as in FMVSS No. 304.

- **Auto Innovators Response #79:** We agree with NHTSA on the need to establish more specific wind protection requirements.

NHTSA NPRM: "*NHTSA is proposing requiring a telltale warning when hydrogen concentration exceeds 3.0 percent in the enclosed or semi-enclosed spaces of the vehicle. Given the serious threat posed by elevated hydrogen levels in the passenger compartment, NHTSA is proposing the visual warning be red in color and remain illuminated while the vehicle is in operation with hydrogen concentration levels exceeding 3.0 percent in enclosed or semi-enclosed spaces of the vehicle. The visual warning must be in clear view of the driver. For a vehicle with automated driving systems and without manually-operated driving controls, the visual warning must be in clear view of all the front seat occupants. NHTSA seeks comment on whether the warning should be in clear view of all occupants, including occupants in rear seating positions, in vehicles with automated driving systems. NHTSA also seeks comment on whether an auditory warning be required when hydrogen concentration exceeds 3.0 percent in the enclosed or semi-enclosed spaces of the vehicle.*

- **Auto Innovators Response #80:** With respect to vehicles with automated driving systems (ADS), we anticipate that the current FMVSS No. 101 requirements will need to include accommodations for vehicles without manual driving controls or a conventional driver's seat. However, any accommodations will likely need to be consistent with how other FMVSS are amended to address the applicability and appropriateness of certain safety telltales and warnings. With no clear direction or timing from the agency on how it plans to proceed on this issue, it is not possible to fully answer the question on whether the warning should be in clear view of all occupants, or what "clear view" might imply - it is not objective. We urge NHTSA to continue to prioritize this issue, as well as other initiatives to help support increased regulatory modernization for ADS-equipped vehicles.

  In the near term, we recommend that NHTSA consider only requiring placement consistent with current requirements. Similarly, NHTSA should not seek to require a not require an auditory warning for vehicles with ADS in the absence of further research. Near term flexibility may be needed to allow for vehicle-specific alerts to be provided depending on the level of automation and the need to minimize potential consumer confusion**.**

NHTSA NPRM: "*NHTSA is also proposing that a telltale be activated if the hydrogen warning system malfunctions, such as in the case of a circuit disconnection, short circuit, sensor fault, or other system failure. NHTSA proposes that when the telltale activates for these circumstances that it illuminates as yellow to distinguish a malfunction of the warning system from that of excess hydrogen concentration.*

- **Auto Innovators Response #81:** Auto Innovators supports the agency's proposal which is consistent with GTR No. 13.

Post-crash fuel system integrity.

NHTSA NPRM: "*In accordance with GTR No. 13, NHTSA is proposing that the post-crash requirements only apply to passenger cars, multipurpose passenger vehicles, trucks and buses with a GVWR less than* *or equal to 4,536 kg (10,000 pounds) and to all school buses, that use hydrogen fuel for propulsion power. NHTSA is not proposing that these post-crash requirements apply to all heavy vehicles with a GVWR greater than 4,536 kg (10,000 pounds). We are tentatively making this decision because there is not a comparable crash test for heavy vehicles to conduct the tests necessary for compliance assessment. NHTSA seeks comment on whether heavy vehicles should be subject to these proposed post-crash requirements and if so, what crash tests should NHTSA conduct on heavier vehicles.*

- **Auto Innovators Response #82:** The safety and integrity of hydrogen vehicles is a priority regardless of vehicle size. However, based on the research and supporting information provided in the NPRM, Auto Innovators does not support the inclusion of heavy vehicles in FMVSS 307 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 the safety performance of these vehicles. Similar to the comments Auto Innovators provided in response to the NPRM on FMVSS 305a, we recommend that 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).[14,15] 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.

NHTSA NPRM: "*NHTSA has determined that it is appropriate to apply equivalent crash tests to hydrogen vehicles as those for conventionally fueled vehicles. NHTSA seeks comment on whether there are alternative crash tests that should be used for the forthcoming proposed regulations.*

- **Auto Innovators Response #83:** We agree that it is appropriate to apply equivalent crash tests to hydrogen vehicles with GVWR ≤ 10,000 lbs. as for conventionally fueled vehicles. Existing crash tests are representative of commonly occurring crashes in the field and should be suitable for assessing the post-crash fuel system integrity of hydrogen vehicles. In the absence of data demonstrating the need for alternative crash tests, we recommend additional crash tests be excluded from the proposed regulation at this time.

NHTSA NPRM: "*For the purpose of measuring the hydrogen concentration, GTR No. 13 specifies that data from the sensors shall be collected at least every five seconds and continue for a period of 60 minutes. GTR No. 13 also discusses filtering of the data to provide smoothing of the data, but is unclear about the exact data filtration method to be used. NHTSA proposes using a three data point rolling average for filtering the data steam. Since a data point will collected at least every five seconds, this rolling average will be, at most, a 15-second rolling average. NHTSA seeks comment on this proposed data filtration method.*

- **Auto Innovators Response #84:** We agree with the proposed data filtration method for smoothing of the data.

[14] 89 FR 26704
[15] https://www.regulations.gov/comment/NHTSA-2024-0012-0027

NHTSA NPRM: "*NHTSA seeks comment on the possibility of including a moving contoured barrier impact test on heavy vehicles (other than school buses) in accordance with S6.5 of FMVSS No. 301. This test would allow for a moving contoured barrier to impact the CHSS along with shields, panels, and protective structures specified by the manufacturer at any angle. Such an impact test would evaluate the ability of side-saddle mounted CHSS to withstand light vehicle impacts and meet the allowable leakage limits.*

- **Auto Innovators Response #85:** Based on the research and supporting information provided in the NPRM, Auto Innovators opposes the inclusion of heavy vehicles in FMVSS 307 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 the overall safety performance of Hydrogen Vehicles. Extending the proposed requirements without such consideration will have an unknown impact on motor vehicle safety and could result in potential unintended consequences. Similar to the comments Auto Innovators provided in response to the NPRM on FMVSS 305a, we recommend that 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).[16,17] 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.

Lead Time

NHTSA NPRM: "*NHTSA is proposing that the rule take effect the September 1st the year after the final rule is published. As discussed above, NHTSA believes that the requirements in the proposal are closely aligned to current industry practice and manufacturers will not require an extended lead- time. NHTSA seeks comment on whether any of the requirements necessitate additional lead- time.*

- **Auto Innovators Response #86:** Auto Innovators is concerned with the proposed lead time suggested in the NPRM. We have not fully assessed the cumulative impact of dis-harmonization with GTR No. 13, and the additional regulatory impact that this creates by requiring US-specific design and testing requirements without a clear added safety benefit. However, based on our initial assessment, we anticipate at least 5 additional years will be required beyond the one-year compliance date in the proposed rule. This is necessary to allow time for manufacturers to change designs, adjust hardware procurement, and make software changes to vehicle safety systems.

Other

General comments on test conditions

In several instances in the regulatory test procedures, the agency has proposed to use a range of test condition values, in lieu of the minimum or maximum values specified in GTR No. 13. While we generally support specificity for the purposes of testing objectivity, our experience is that these ranges are too narrow and may not be practicable. We recommend that these ranges be replaced with the minimum

---

[16] 89 FR 26704

[17] https://www.regulations.gov/comment/NHTSA-2024-0012-0027

and maximum values currently specified in GTR No. 13. This would maintain the stringency of the proposed test conditions while also ensuring that the tests can be practically conducted.

Section	**Comments / Proposed edits**
Definitions (S4)	The definitions for shut off valve in FMVSS Nos. 307 and. 308 are not the same. We recommend harmonizing with the GTR No. 13 definition: "Shut-off valve" is a valve between the storage container and the vehicle fuel system that must default to the "closed" position when not connected to a power source
S5.1.1.2.	When a new container with its container attachments (if any) is hydraulically pressure cycled in accordance with S6.2.2.2 to ≧**125.0 percent NWP**,
S5.1.2.1.	The container with its container attachments (if any) is hydraulically pressurized in accordance with S6.2.3.1 to ≧**1.500 times NWP** and held for ≧ **30.0 seconds**.
	The container is exposed to chemicals in accordance with S6.2.3.4 and then hydraulically pressure cycled in accordance with S6.2.3.4 for 60 percent of the number of cycles as specified in S5.1.1.2(a)(1) or S5.1.1.2(b)(1) as applicable. For all but the last 10 of these cycles, the cycling pressure shall be ≧**125.0 percent NWP**. For the last 10 cycles, the pressure shall be ≧ **150.0 percent NWP**.
S5.1.2.5.	The container is pressurized to ≧**125 percent NWP** and held at that pressure **no less than 1,000 hours** in accordance with S6.2.3.5 and with the temperature surrounding the container **at ≧ 85.0 °C.**
S5.1.2.6.	The container is pressure cycled in accordance with S6.2.3.6 for 40 percent of the number of cycles specified in S5.1.1.2(a)(1) or S5.1.1.2(b)(1) as applicable. The pressure for the first half of these cycles **is ≧80.0 percent NWP** with the temperature surrounding the container ≦ **−40.0 °C**. The pressure for the next half of these cycles **is ≧125.0 percent NWP** and the temperature surrounding the container **is ≧ 85.0 °C** and the relative humidity surrounding the container not less than 80 percent.
S5.1.3.1.	The container of the CHSS is pressurized with hydrogen gas to ≧**1.500 times NWP** and held for ≧**30 seconds** in accordance with the S6.2.3.1 test procedure. The ambient temperature surrounding the container shall be at any temperature between 5.0 °C to 35.0 °C. The fuel delivery temperature used for pressurizing the container with hydrogen shall be at any temperature between −40.0 °C to −33.0 °C.
S5.1.5.2.	"Check valve and shut-off valve qualification requirements" sections (d), (e) and (h) are referring to test specifications under section S6.2.6.1. "TPRD performance tests" is misleading (even though test specification for check and shut-off valves are similar (GTR13 is referencing test procedures twice)
S6.2.6.2	Check valve and shut-off valve performance tests": Test specifications not clearly structured comparing to performance requirements under section S5.1.5.2 (i.e., there is no dedicated subchapter for the flow rate test)
S5.1.3.4.	The container of the CHSS is hydraulically pressurized in accordance with S6.2.3.1 to ≧ **1.800 times NWP** and held at that pressure for **duration ≧ 240 seconds**.

S5.1.5.2.	(c)(1) A check valve shall meet the requirements when tested sequentially as follows: (i) The check valve shall reseat and prevent reverse flow after each cycle when subjected to 13,500 pressure cycles in accordance with S6.2.6.2.3 to pressure ≧ **100.0 percent NWP** and at any temperature between 5.0 °C and 35.0 °C; (ii) The same check valve shall reseat and prevent reverse flow after each cycle when subjected to 750 pressure cycles in accordance with S6.2.6.2.3 to pressure ≧**125.0 percent NWP and at temperature** ≧ **85.0 °C**; (iii) The same check valve shall reseat and prevent reverse flow after each cycle when subjected to 750 pressure cycles in accordance with S6.2.6.2.3 to any pressure ≧ **80.0 percent NWP and at any temperature** ≦ **−40.0 °C;**
S5.1.5.2.	(c)(2) A shut-off valve shall meet the requirements when tested sequentially as follows: (i) The shut-off valve shall be subjected to 45,000 pressure cycles in accordance with S6.2.6.2.3 to any pressure ≧ **100.0 percent NWP** and at any temperature between 5.0 °C and 35.0 °C; (ii) The same shut-off valve shall be subjected to 2,500 pressure cycles in accordance with S6.2.6.2.3 to any pressure ≧ **125.0 percent NWP and at any temperature** ≧ **85.0 °C**; (iii) The same shut-off valve subjected to 2,500 pressure cycles in accordance with S6.2.6.2.3 to any pressure ≧ **80.0 percent NWP** and at any temperature ≦ **−40.0 °C**;
S6.2.2.2.	(c) The container is pressure cycled at any pressure **2.0±1.0 MPa** up to the pressure specified in the respective section of S5. The cycling rate shall be any rate between or equal to 5 and 10 cycles per minute. Cycling rate should be in line with Table 3 ≦10 cycles per minute
S6.2.3.2	In sub-section (b) and (c), the NPRM states as "any potential energy of between 488J and 538J". In GTR No.13, the potential energy of 488J is used to calculate the drop height based on the mass of the container. Therefore, there is no tolerance provided for this potential energy value. The NPRM simply increases the severity of the requirement from that of GTR No.13 with no justification for this increase. Auto Innovators suspects the addition of the range may be an error and recommends the potential energy be aligned with GTR No. 13 at only 488J
S6.2.3.4.	(c) The exposure of the container with the glass wool is maintained for ≧ **48 hours** with the container hydraulically pressurized to any pressure ≧ **125.0 percent NWP**. During exposure, the temperature surrounding the container is maintained at any temperature between 5.0 °C and 35.0 °C. Tolerances for the concentration of the chemicals in this specific section should align with the ones in GTR No. 13 section 6.2.3.4
S6.2.4.1.	(b) The CHSS is pressure cycled from any pressure ≦ **2.0 MPa** up to any pressure within the specified peak pressure range in accordance with the Table to S5.1.3.2. The temperature of the hydrogen fuel dispensed to the container is controlled to within the specified temperature range within 30 seconds of fueling initiation. The specified number of pressure cycles are conducted.
S6.2.4.2.	(a) A CHSS is filled with hydrogen gas to any **SOC** ≧ **100.0 percent** and placed in a sealed container. The CHSS is held for any duration ≧ **12 hours** at any temperature between 55.0 °C and 60.0 °C prior to the start of the test.
S6.2.5.3.	(e) The CHSS shall be filled with compressed hydrogen gas to **any SOC** ≧ **100.0 percent**.

S6.2.6.1.1.	Pressure cycling test. A TPRD undergoes 15,000 internal pressure cycles at a rate not exceeding 10 cycles per minute. The table below summarizes the pressure cycles. Any condition within the ranges specified in the table may be selected for testing. (a) The first 10 pressure cycles shall be from any low pressure ≦ **2.0 MPa** to any high pressure ≧ **150.0 percent NWP**. These cycles are conducted at any sample **temperature ≧ 85.0 °C.** (b) The next 2,240 pressure cycles shall be from any low pressure ≦ **2.0 MPa** to any high pressure ≧**125.0 percent NWP**. These cycles are conducted at any sample **temperature ≧ 85.0 °C**. (c) The next 10,000 pressure cycles shall be from any low pressure ≦ **2.0 MPa** to any high pressure ≧ **125.0 percent NWP**. These cycles are conducted at a sample temperature between 5.0 °C to 35.0 °C. (d) The final 2,750 pressure cycles shall be from any low pressure ≦ **2.0 MPa** to any high pressure ≧ **80.0 percent NWP**. These cycles are conducted at any sample temperature ≦ **–40.0 °C.**
S6.2.6.1.2.	(b) The TPRDs are placed in an oven or liquid bath maintained within 5.0 °C of the specified temperature per S6.2.6.1.2(a). The TPRD inlets are pressurized with hydrogen to ≧ **125.0 percent NWP** and time until activation is measured.
S6.2.6.1.3.	Temperature cycling test. (a) An unpressurized TPRD is placed in a cold liquid bath maintained at any temperature ≦ **–40.0 °C.** The TPRD shall remain in the cold bath for any duration **not less than 2 hours**. The TPRD is removed from the cold bath and transferred, within five minutes of removal, to a hot liquid bath maintained at any temperature ≧ **85.0 °C**. The TPRD shall remain in the hot bath for any duration **not less than 2 hours**. The TPRD is removed from the hot bath and, within five minutes of removal, transferred back into the cold bath maintained at any temperature ≦ **–40.0 °C**; (b) Step (a) is repeated until 15 thermal cycles have been achieved. (c) The TPRD remains in the cold liquid bath for any duration **not less than 2 hours**, then the internal pressure of the TPRD is cycled with hydrogen gas from any pressure ≦ **2.0 MPa** to any pressure ≧ **80.0 percent NWP** for 100 cycles. During cycling, the TPRD remains in the cold bath and the cold bath is maintained at any temperature ≦ **–40.0 °C**.
S6.2.6.1.4.	(e) The drying stage shall occur in the following environmental conditions: any temperature **60 ±2 °C** and relative humidity no more than 30 percent with air circulation. The tolerance for the test cycle time should aligned with GTR No. 13, table 10 "Optional Tolerances for Test Parameters" 24 +2/-0
S6.2.6.1.4	For the salt corrosion resistance test, the NPRM contains an apparent error with a sodium chloride concentration of "0.08" percent. We believe this should be corrected to "0.9" percent consistent with GTR No. 13.
S6.2.6.1.6.	(b) The closure device is continuously exposed to a moist ammonia air mixture maintained in a glass chamber having a glass cover. The exposure lasts any duration **not less than 240 hours.** The aqueous ammonia shall have any specific gravity not less than 0.940 and not more than 0.941. Aqueous ammonia shall be located at the bottom of the glass chamber below the sample at any volume not less than 20 mL and not more than 22 mL of aqueous ammonia per liter of chamber volume. The bottom of the sample is positioned any distance not less than 30 and not more than 40

	millimeters above the aqueous ammonia and supported in an inert tray. (c) The moist ammonia-air mixture is maintained at atmospheric pressure and any temperature **35 ±5 °C.**
S6.2.6.1.8.	(a) The TPRD shall be thermally conditioned at test temperatures in each of the test conditions and held for any duration ≧ **1.0 hour**. The TPRD is pressurized with hydrogen at the inlet. The required test conditions are: (1) Ambient temperature: condition the TPRD at any temperature between 5.0 °C and 35.0 °C; test in accordance with S6.2.6.1.8(b) at any pressure between 1.5 MPa and 2.5 MPa and then at any pressure ≧ **125.0 percent NWP**. (2) High temperature: condition the TPRD at any temperature ≧ **85.0 °C**; test in accordance with S6.2.6.1.8(b) at any pressure between 1.5 MPa and 2.5 MPa and then at any pressure ≧ **125.0 percent NWP**. (3) Low temperature: condition the TPRD at any temperature ≦ **–40.0 °C**; test in accordance with S6.2.6.1.8(b) at any pressure between 1.5 MPa and 2.5 MPa and then at any pressure ≧ **100.0 percent NWP** .
S6.2.6.1.9.	(b) The temperature of the oven or chimney is at any temperature **600.0 ±10 °C** for any duration ≧ **2 minutes** prior to inserting the TPRD.
S6.2.6.1.9.	(d) The pressurized TPRD is inserted into the oven or chimney, the temperature within the oven or chimney is maintained at any temperature **600.0 ±10 °C**, and the time for the TPRD to activate is recorded. If the TPRD does not activate within 120 minutes from the time of insertion into the oven or chimney, the TPRD shall be considered to have failed the test.
S6.2.6.2.1.	(b) Any hydrostatic pressure ≧ **250.0 percent NWP** is applied using water to the valve inlet for any duration ≧ **180.0 seconds**. The unit is examined to ensure that burst has not occurred.
S6.2.6.2.2.	(a) Each unit shall be pressurized to any pressure ≧ **2.0 MPa** and held for any duration ≧ **1.0 hour** in the specified temperature range before testing. The outlet opening is plugged. The test conditions are:
S6.2.6.2.2.(a)	(1) Ambient temperature: condition the unit at any temperature **20 ±5.0 °C**; test at any pressure between 1.5 MPa and 2.5 MPa and at any pressure ≧ **125.0 percent NWP**. (2) High temperature: condition the unit at any temperature ≧ **85.0 °C**; test at any pressure between 1.5 MPa and 2.5 MPa and any pressure ≧ **125.0 percent NWP**. (3) Low temperature: condition the unit at any temperature ≦ **–40.0 °C**; test at any pressure between 1.5 MPa and 2.5 MPa and any pressure ≧ **100.0 percent NWP**.
S6.2.6.2.3.	(b) For a check valve, the pressure is applied in six incremental pulses to the check valve inlet with the outlet closed. The pressure is then vented from the check valve inlet. The pressure is lowered on the check valve outlet side to any pressure ≦ **60.0 percent NWP** prior to the next cycle;
S6.2.6.2.6.	(a) The valve is pressurized with hydrogen to any pressure ≧ **100.0 percent NWP**, sealed at both ends, and vibrated for any duration between 30.0 and 35.0 minutes along each of the three orthogonal axes (vertical, lateral and longitudinal) at the most severe resonant frequencies. The tolerance for the vibration test time should aligned with GTR No. 13, table 10 “Vibration time” 30 mins +1/-0

FMVSS 307

S5.2.2.	**Concentration limit in enclosed spaces** 1) Text not specific enough: Shall only one of the requirements from (a) to (c) be met? 2) Requirement (c) "closure of shut-off valves" alone is not sufficient. This should be combined with a "no leakage" requirement (maximum leak of S5.2.1. not sufficient enough to ensure that there is no critical concentration in any enclosed or semi-enclosed space
S6.5	**Test for the vehicle exhaust system.** (c) "After one minute", not sufficient to ensure that the start-up process of the fuel cell has been completed. We recommend following amended requirement of GTR No. 13 "After completion of the start-up process as defined by the manufacturer" "After completion of the start-up process as defined by the manufacturer" (d) / (e) "resolution time of less than 300 milliseconds" is specified twice
S6.4.1.	Test for hydrogen gas leakage detectors. **(a) The vehicle shall be set to the "on" or "run" position for at least 5 minutes prior to testing….** GTR No. 13 requests a warmup to its normal operating temperature. Based on this, we strongly recommend adhering to GTR No. 13 **Same comment applies to:** S6.4.2. Test for integrity of enclosed spaces and detection systems. S6.5. Test for the vehicle exhaust system. S6.6. Test for fuel system leakage.
S6.4.1	Test for hydrogen gas leak detectors. b) Two mixtures of air and hydrogen gas shall be used in the test: The first test gas has any hydrogen concentration between 3.0 and 4.0 percent by volume in air to verify function of the warning, and **the second test gas has any hydrogen concentration between 4.0 and 6.0 percent by volume in air to verify function of the shut-down.** Propose adding the following notes as in GTR No. 13: NOTE 1: The proper concentrations are selected based on the recommendation (or the detector specification) by the manufacturer. NOTE 2: The storage of pre-mixed gases of greater than 2 per cent hydrogen in air in compressed gas cylinders may be restricted or prohibited in various jurisdictions where test laboratories are located. As an alternative, gas mixtures up to 4 per cent hydrogen in situ within the test area by a mixing station that injects the required amount of hydrogen into a flowing streaming of air. The hydrogen/air mixture can then be delivered to the point of release within the vehicle by a flexible hose. Alternatively, a test gas mixture of hydrogen and nitrogen could be used.
S6.4.2.	Test for integrity of enclosed spaces and detection systems. (h) The **test is completed 5 minutes after initiating the simulated leak**

	GTR No. 13 requires continuing the test until the shutoff valves are closed, so based on that, we recommend adhering to GTR No. 13.
S6.5.	Test for the vehicle exhaust system. (2) The fuel cell system shall be **immediately** restarted. GTR No. 13 establishes: (b) **Upon completion of the shut-down process**, the power system is immediately started. (3) **After one minute**, the vehicle shall be set to the "off" position and measurement continues until the until the vehicle shut-down is complete shut-down procedure is completed. GTR No. 13 establishes: (c) **After completion of the start-up process as defined by the manufacturer**, the power system is turned off and measurement continues until the power system shut-down procedure is completed For the above reasons, we recommend following GTR No. 13