ALLIANCE FOR AUTOMOTIVE INNOVATION

February 8, 2021

Mr. Ryan Posten
Associate Administrator, Rulemaking
National Highway Traffic Safety Administration
1200 New Jersey Avenue, S.E.
Washington, D.C. 20590

RE: Advance Notice of Proposed Rulemaking (NPRM); Federal Motor Vehicle Safety Standards: Test Procedures, NHTSA Docket No. 2020-0109, 85 Fed. Reg. 79456 (December 10, 2020)

Dear Mr. Posten:

The Alliance for Automotive Innovation (Auto Innovators) appreciates this opportunity to provide comments supporting the National Highway Traffic Safety Administration (NHTSA or "Agency") efforts to identify and resolve FMVSS test procedures that are candidates for replacement, repeal, or modification for conventional non-ADS equipped vehicles.

As detailed in our January 14, 2021, request to extend the comment period for this notice, Innovators is conducting a comprehensive review of the extensive number of regulations and Federal Motor Vehicle Safety Standards (FMVSSs) that contain detailed test procedures. In addition, many of these regulations and FMVSSs have requirements and test procedures that reference industry standards (e.g., SAE, ISO, ANSI) many of which are out of date and some of which are even cancelled. Some of these issues may have more substantive aspects and may potentially require rulemaking as well. In such cases, we recommend that the agency include the issue in other appropriate rulemaking actions. If the issue is such that it cannot be addressed in another existing rulemaking, then we ask that it be treated as a petition for rulemaking.

Adequate lead-time/alternative compliance options should be provided for changes that involve regulatory revisions or updates to referenced industry standards (e.g., SAE, etc.) that could influence current vehicle certifications.

Our comments detailed in Appendix A reflect our progress to date and for some topics, Innovators will provide supplemental comments providing further detail and specific recommendations. We will also provide an indication of our assessment of the relative importance and urgency of each topic to help the agency identify those that should be addressed first.

Auto Innovators appreciates the opportunity to provide input to NHTSA on this important topic. We look forward to any follow up with the agency to expand on these comment s further.

Sincerely,

Scott Schmidt
Vice President, Safety Policy

Enclosure

cc:

M. Versailles

APPENDIX A

Auto Innovators Recommended Candidates for FMVSS Test Procedure Replacement, Repeal, or Modification

Multiple Standards – Update of SAE J826 with SAE J4002

Issue:

SAE J826: *Devices for Use in Defining and Measuring Vehicle Seating Accommodation*, is referenced in several FMVSS ... 111, 202a, 207, 208, 210, 216a, and 225. It is also referenced in FMVSS test procedures including 201, 203, 212, 219, and 301. However, it is out-of-date and has been replaced by SAE J4002; *H-Point Machine (HPM-II) Specifications and Procedure for H-Point Determination*.

Currently many UNECE regulations also reference J826 such as UN-R14, R17, R125, etc. A lack of harmonization between FMVSS and UNECE regulations regarding the determination of H-point and eye ellipse locations will add unnecessary complexity and cost impacts on vehicle design and testing.

Updating the references from J826 to J4002 for measuring H-point, torso angle, and head restraint locations in the various FMVSS that reference J826 may have compliance implications for vehicles currently certified to the existing SAE J826.

In addition, many test procedures reference different versions of SAE J826. However, it appears that many test houses use the most recent version as a matter of practice.

Recommendation:

Innovators recommends that NHTSA coordinate with its international partners (UNECE) to transition from H-Point and Eye Ellipse determinations based on SAE J826 with those based on SAE J4002. In addition to the development and coordination of international transitional accommodations, we recommend that changes to reference J4002 in the applicable FMVSS include a 4-year transition period where compliance with both standards would be permitted.

In the meantime, Innovators recommends that the FMVSS test procedures be modified to reference the most recent version of J826.

FMVSS No. 103: Windshield defrosting and defogging systems

Issue:

FMVSS 103 currently references SAE J902 (August 1964 or March 1967) that was drafted before electric powertrains were widely used.

FY TP 103-13 test procedure does not address propulsion systems other than conventional internal combustion engines (e.g., battery and fuel cell electric). This lab test procedure includes numerous references to internal combustion engines, including the terms “engine” and “gasoline.”

Recommendation:

We recommend that the regulation adopt the latest SAE J902 (September 2019) without the inclusion of performance criteria for MPV’s (i.e., update test procedures but keep the requirements of the standard the same) and that the lab test procedure also be modified to align with any amendments to FMVSS 103, including the translation of the existing terms to “propulsion system” and “fuel or state of charge. The September 2019 version of SAE J902 includes appropriate language to accommodate unconventional powertrains.

Issue:

In addition, the test procedure, when applied to electric vehicles, lacks a definition/procedure on how to cold soak the battery pack, or what level of battery pre-conditioning is required.

Recommendation:

An appropriate battery pre-conditioning and cold soak procedures should be developed.

FMVSS No. 104: Windshield wiping and washing systems.

Issue:

The SAE Wiper Standards Committee has been working on a proposal to standardize the use of SAE J941 2010 (Motor Vehicle Drivers Eye Locations) . Current industry practice is to calculate wiper pattern coverage using SAE J941 1965. The newer specification has a revised eye ellipse that sits higher in the vehicle and more closely matches the average size of a driver circa 2020 vs the old spec in 1960s. Adopting the newer specification would coordinate with other SAE Committees already using the 2010 version (e.g., the Driver Vision Standards Committee). The same calculation is used for both wipers (FMVSS 104) and defrosters (FMVSS 103). To maintain the current wiper systems which are doing well in the field with few vision complaints, the Area B requirement would have to be reduced from 94% to 92%.

In addition, changes to the eye ellipse will have compliance implications on a number of other standards that reference the existing 1965 version of the SAE standard. As a result, we recommend that changes to reference the 2010 version of the standard/new eye ellipse position include a 4-year transition period where compliance with both standards/eye ellipse positions would be permitted.

Recommendation:

Update the requirements to the 2010 version of J941 with the new eye ellipse, revise the area B requirement from 94% to 92%, and provide a 4-year optional compliance transition period for revisions to the Area B requirements and standards referencing SAE J941 1965.

Issue:

Currently windscreen vision areas are different between FMVSS 103/104 and UNECE regulation 43. Innovators is unaware of any significant safety benefit differences between the two requirements. As such the cost burdens due to dis-harmonization are not offset by any tangible benefits for maintaining different standards.

Recommendation:

Harmonize windscreen vision areas between FMVSS 103/104 and UNECE Regulation 43 vision areas A and B contained in Annex 18 to that regulation.

Issue:

FMVSS 104 currently references internal combustion engines. FMVSS 104 also references SAE J903a (May 1966) and SAE J942 (November 1965)..

FY TP104-08 test procedure does not address propulsion systems other than conventional internal combustion engines (e.g., battery and fuel cell electric) or rain sensor technology. This lab test procedure includes numerous references to internal combustion engines, including the terms “engine” and “gasoline.”

Recommendation:

Similar to FMVSS 103 above, we recommend that the FMVSS adopt the latest SAE J903 and SAE J942 as needed to update the test procedure without changing the performance requirement. We also recommend that the laboratory test procedure be modified to align with any amendments to FMVSS 104, including the translation of the existing terms to “propulsion system” and “fuel or state of charge.”

In addition, specific recommended mark ups to FMVSS No. 104 are provided in Appendix C.

FMVSS No. 105: Hydraulic and electric brake systems

See common issues under FMVSS 135

FMVSS No. 108: Lamps, reflective device and associated equipment

Issue:

FMVSS No. 108 requires a dust test of headlamps using Portland Cement produced to specification ASTM C150-77 (April 1977) and a similar test for signal lamps and reflective devices using Portland Cement produced to specification ASTM C150-56 (1956). Portland Cement identified as meeting either of these vintages of the ASTM C150 specification has not been commercially available for many years. The use of Portland Cement for a lighting dust test is a casual use of a material that's primary use is for construction. The attributes that made it useful for a dust test in 1956 and 1977 very likely still exist in the Portland cement available today. Currently available Portland Cement states that it, "Complies with Current ASTM C-150 and Federal Specifications for Portland Cement".

Recommendation:

The agency should require Portland Cement used for lighting dust tests to be compliant with the "Current ASTM C-150".

Issue:

FMVSS No. 108 contains several test procedure requirements predicated on devices having specific design voltages or operating ranges. Design voltage is a defined term in S4. Voltages specified include; 5.5 VDC, 6.4 VDC, 6.5 VDC, 7 VDC, 11 VDC, 12 VDC, 12.8 VDC, 13 VDC, 14 VDC, and 15 VDC.

Based upon an initial review, Auto Innovators has identified several applicable sections where test procedure changes are necessary to support the introduction innovative and advanced lighting systems that are designed to function with different design voltage or operating ranges. Please note, the following is not intended as an exhaustive list and we encourage the agency to provide necessary flexibility in other sections of the test procedure where the design voltage has been unnecessarily specified.

S10.18.9.4.2 Visual/optical aiming

S14.2.4.1 DRL photometry

S14.2.5.4 Headlamp and headlamp light sources seasoning

S14.2.5.5.6.2 Visually/optically aimable upper beam headlamps-horizontal aim

S14.6.4.1.1 Corrosion-connector test [sealed beams]

S14.6.9.1.1 Sealing test [sealed beams]

S14.6.16.1 Headlamp wattage test [sealed beams]

S14.7.3.2 Replaceable light source power and flux measurement procedure [headlamp bulb]

S14.9.1.1 Power supply specifications [turn signal operating unit-alternative to use 6,4 VDC presumably for vehicles using a nominal 6 volt electrical system]

S14.9.2.2 Performance requirements -Vehicular hazard warning signal operating unit durability test-alternative to use 6.4.VDC]

S14.9.3.1.1.3 Turn signal flasher and vehicular hazard warning signal flasher tests [alternative to use 6.4 VDC]

S14.9.3.1.1.5 Turn signal flasher and vehicular hazard warning signal flasher tests [alternative to use 6.4 VDC]

S14.9.3.4.2.1 Turn signal flasher starting time test [alternative to use 6.4 VDC]

S14.9.3.5.2.2 Turn signal flasher flash rate and percent current "on" time test [alternative to use 6.4 VDC][

S14.9.3.6.2.1 Turn signal flasher durability test [alternative to use 6.4 VDC]

S14.9.3.6.2.2 Turn signal flasher durability test [14 VDC with alternative to use 7.0 VDC]

S14.9.3.6.3 Turn signal flasher durability test [alternative to use 6.4 VDC]

S14.9.3.9.2.3 Vehicular hazard warning signal flasher flash rate and percent "on" time test [12 VDC with alternative to use 6.4 VDC, 11 VDC with alternative to use 5.5 VDC. 13 VDC with alternative to use 6,5 VDC]

S14.9.3.10.2.1 Vehicular hazard warning signal flasher durability test [alternative to use 6.4 VDC]

S14.9.3.10.2.2 Vehicular hazard warning signal flasher durability test [13 VDC with alternative to use 6.4 VDC]

S14.9.3.10.3 Vehicular hazard warning signal flasher durability test [alternative to use 6.5 VDC]

S14.9.3.11.1 Semiautomatic headlamp beam switching device tests [13 VDC required]

S14.9.3.11.3.1.2 Voltage regulation test [11 VDC and 15 VDC]

S14.9.3.11.3.2 Voltage regulation test [11 VDC and 15 VDC]

S14.9.3.11.11.1.2 Durability test [13 VDC]

Recommendation:

Where applicable NHTSA should provide flexibility to permit the "design input voltage" as an alternative to a specific voltage, where specified within the existing test procedure requirements. In addition, where an operating range is specified, NHTSA should allow an alternative operating range that includes a percentage below and above the nominal design voltage.

Issue:

NHTSA compliance currently interprets "diffusion" and "haze" as the same thing. Diffusion is a scattering of light whether intentional or not. Haze is the degradation of the lens due to weathering—

it is a delta change to the lens's clarity. Diffuse plastic materials now exist which can be used as inner lenses. These materials can have as much as 90% diffusion built into the design and the lamps can still meet the existing photometrics. The issue can be resolved by clarifying the test procedure that FMVSS-108 "haze" is calculated by subtracting the initial haze measurement from the measurement after weathering.

Recommendation:

Change the lens "haze" definition in the test procedure (from "weathering") to allow diffuse inner lenses. Auto Innovators believes that this matter can be resolved with a test procedure change, but it is possible that the Agency might conclude that rulemaking is necessary to ensure consistent definitions.

Issue:

Auto Innovators is expecting NHTSA to publish a final rule regarding adaptive driving beam (ADB) systems.

Recommendations:

We encourage the agency to move expeditiously in finalizing updates to FMVSS No. 108 to support the deployment of advanced lighting systems. Once this rule is issued, OVSC should expedite an update of the test procedures to include the updated regulatory provisions.

Issue:

The FMVSS 108 test procedure (section 12.12.4) dictates the rear reflex reflector mounting location be "In a location where it complies with all the applicable photometric requirements". The testing is performed with the goniometer centered on the center of the reflector in a lab environment. The regulation and test procedure also require the mounting height of the center of the reflector on the vehicle to be not less than 15 inches and no more than 60 inches from the ground. It is possible for a reflector to be mounted with its center less than 15 inches to the ground while still meeting the photometric requirements as installed (i.e. the goniometer centered on the reflector at 15 inches from the ground). This means the current range of "centered at 15-60 inches" would have a photometrically compliant reflector with additional reflective area below, which does not have a detrimental effect on safety but only increases the conspicuity of the vehicle.

Examples of this scenario were petitioned as inconsequential noncompliances by Harley-Davidson[1] and Porsche[2]. Harley-Davidson presented compliance photometric test data with the center of the reflector from 11" – 15" above the road surface. NHTSA's analysis of the Harley-Davidson petition and supporting data was as follows: "NHTSA has concluded that the test data provided by Harley-Davidson relative to the photometric performance of the reflex reflectors as mounted on the subject motorcycles is sufficient justification for NHTSA to concur with Harley-Davidson's assessment that the location of the rear reflex reflectors as mounted on the subject vehicles poses little if any risk to

motor vehicle safety….NHTSA has decided that Harley-Davidson has met its burden of persuasion that the FMVSS No. 108 noncompliance is inconsequential to motor vehicle safety."

Porsche provided compliant photometric test data with the center of the reflector from 14.8" to 15.3"above the road surface. With the testing investigations provided by both companies, NHTSA deemed the mounting height of a rear reflector with the center below the minimum of 15 inches to be an inconsequential noncompliance. NHTSA's analysis of the Porsche petition and supporting data was as follows: "NHTSA has concluded that the test data provided by Porsche is sufficient to grant this petition. The purpose of the mounting height is to aid in the visibility of the reflex reflector from other road users' line of sight."

In addition, the United Nations ECE R48 regulation specifies a minimum mounting height of 250 mm (9.84 inches) for rear retro-reflectors. However, UN ECE R48 also allows for reflective area outside the tested zone, which is specified by the manufacturer, for photometric compliance.

1. Harley-Davidson grant of petition for inconsequential noncompliance: https://beta.regulations.gov/document/NHTSA-2014-0055-0003
2. Porsche grant of petition for inconsequential noncompliance: https://beta.regulations.gov/document/NHTSA-2019-0094-0003

Recommendation:

Update the test procedure to allow the manufacturer to specify the test zone (i.e. where the "certified center" of the reflector is and where to center the goniometer for testing). This would be aligned with NHTSA's decisions of inconsequential noncompliance of having reflective area below the "certified area" when reflector is tested as if its center was at 15 inches to the ground in the two examples above, as well as be aligned with the ECE procedure of allowing the manufacturer to specify the test zone. *For instance*:

S14.2.3.1 Mounting. Each reflex reflector is mounted for photometry with the center of the reflex area, *as defined by the manufacturer*, at the center of goniometer rotation and at the same horizontal level as the source of illumination. *Reflective area surrounding the reflex area defined by the manufacturer to certify to photometric requirements, shall be covered with non-reflective tape*.

FMVSS No. 110: Tire selection and rims for passenger cars

Issue:

Currently, FMVSS No. 110 S4.4.1(b) is evaluated using a full vehicle test per NHTSA OVSC's test procedure. However, bench testing that is used to evaluate "bead unseating resistance" in FMVSS Nos. 109 and 139 could be used as supporting data (i.e. "indicant") to demonstrate compliance with the tire retention test specified in FMVSS No. 110 S4.4.1(b).

Recommendation:

To reduce the testing burden associated with full vehicle testing, Innovators recommends that NHTSA permit compliance to FMVSS No. 110 S4.4.1(b). using the "bead unseating resistance test in FMVSS No. 109 and 139.

FMVSS No. 111: Rear view and side view mirrors

Issue:

13.2 D. REARVIEW IMAGE RESPONSE TIME (S5.5.3, S6.2.3, S14.2) (Data Sheet 13)

2. Tap into the rear backup lamps signal wiring or affix a photoreceptor to the backup light lens for a time zero trigger source/ indicator, to identify at what point the vehicle transmission gear selector (lever, rotating knob, push button) is placed into reverse. Verify with video or an observer, the time delay, if any, between the gear selector in reverse and the rear backing lights activated. If there is limited to no time delay this light activation can be used to determine when the gear selector is placed in reverse. If there is a delay, mount a contact switch at the transmission shift selector which outputs a voltage signal when selector is placed in reverse(T1). Identify method utilized and confirm that the signal is occurring simultaneous to the selector being placed into reverse (e.g. reverse light activates without lag time when gear selector placed into reverse).

The test procedure does not specify an objective assessment of what is considered a "delay" in time between gear selection and backing light activation. There is no method listed for measuring the time and no indication of what length is considered a “delay.”

Recommendation:

The video recording made during FMVSS 111 backup camera image field-of-view verifications should time-stamp “Reverse Onset” on the video when ‘Reverse’ is selected. In addition, a definition of acceptable “image onset delay” also needs to be specified.

Given the difference between electro-mechanical and strictly mechanical systems. separate technology specific definitions for onset of reverse are needed.

FMVSS No. 114: Theft Protection

Issue:

FMVSS 114 - S5.2.1 states that, “The starting system must prevent key removal unless the transmission or gear selection control is locked in “park” or becomes locked in “park” as the direct result of key removal. (See override option S5.2.3 below.).” The test procedure for FMVSS 114 requires that the engine or motor be started, the transmission be shifted into the “drive” position, and the engine or motor switched off. After doing so, the physical device (key fob) is removed from the vehicle, the transmission is shifted to “neutral”, and the tester attempts to restart the engine or motor. If the engine or motor starts without the physical device being located within range of the vehicle, it is determined that the key code is still in the vehicle.

Innovators does not believe that this procedure should be the only means to determine if the key code remains in the vehicle. Other aspects of vehicle behavior including basic electrical system activity or prevention of the activation of the steering wheel lock or central locking system can also be considered as clear indications that the key code has not been removed from the vehicle. In the past, NHTSA has reviewed numerous FMVSS 114 tests conducted at the request of the Office of Vehicle Safety Compliance and indicated that they meet the requirements of the test even though the engine does not restart per the test procedure. Based on that, it appears that the agency has already set the precedent that whether or not the key code remains in the vehicle can be determined by other indicators beyond the very narrow parameters of the test procedure.

Recommendation:

Innovators recommends that the test procedure be amended to state that when the physical device is removed from the vehicle and the gear selector is moved to "neutral" that the key code remaining present in the system can be indicated by:

- Electrical system activity (radio on, lights on, etc) or,
- Inability to lock the steering wheel lock or vehicle door locks or,
- The engine or motor restarting.

FMVSS No. 124: Accelerator control systems

Issue:

The current test procedure was developed for internal combustion powered vehicles featuring a (mechanical) throttle and does not comprehend the current powertrain dynamics of battery or fuel cell electric propulsion or engines, where the "throttle" is, in fact, an electronic control system. As such, the test procedure offers no guidance about how terms like "throttle position" or "throttle plate" are to be interpreted/tested.

Currently the test procedure calls for the accelerator pedal to be depressed to varying levels of Wide Open Throttle (WOT) and then released to evaluate its ability to return to idle in a defined period of time.

The test procedure also requires this to be done while the vehicle transmission is in Park or in Neutral. The most obvious problem with this approach is that electric vehicles would show no reaction in these conditions as the electric drive motor would not spin like internal combustion engines (ICEs) typically do in Park and Neutral. A similar behavior is applicable for hybrid drive systems especially if the electric motor is active during the tests.

A less obvious problem is that these test procedures are based on the notion that there is a 1 to 1 mechanical connection between the accelerator pedal and the engine (throttle control). This was true in the 1970's and 1980's but it has not been true for more than a decade in most vehicles and even longer in some others. Modern accelerator control systems, even in ICEs, utilize various checks and

safety mechanisms such as ISO 26262 functional safety requirements to operate the whole accelerator control system. Therefore, there is no longer a single actuator responsible for returning the throttle back to idle and ensuring that the vehicle does not experience an engine over-run condition. And in some conditions these safety requirements might prevent the system from fully returning to idle in cases of 'cable severance' or other malfunctions so that the driver is able to safely maneuver the vehicle safely out of traffic (e.g., limp-home modes).

Recommendation:

FMVSS No. 124 and the corresponding test procedure should be revised to address current and anticipated future engine technologies. In addition, additional language should be added to the test procedure which would allow, as a manufacturer option, the vehicles to be tested and certified by using torque measurement either using a typical dynamometer or torque measurement devices which directly attach to the axles/wheels of the vehicle.

Examples of such devices are below for reference:

https://www.imcdataworks.com/products/sensor-solutions/wheel-torque-transducer-wtt-dx/

https://www.kistler.com/en/product/type-9294b/?application=13

FMVSS No. 126: Electronic stability control systems

Issue:

In the subject notice, NHTSA indicated that it is considering the removal of the requirement for outriggers when testing crossover vehicles (which are typically classified as MPVs), as a way to reduce test costs.

Recommendation:

Innovators agrees that most crossovers would not need to be tested with outriggers. However, we believe that the decision whether to use outriggers should be based on the vehicle's static stability factor (SSF) with outriggers fitted on vehicles with a SSF ≤ 1.25 (i.e., harmonized with ECE R140). With respect to the weight categorization of outriggers, we believe that these do not need to be modified.

Issue:

The test procedure for FMVSS 126 contains the following language regarding the performance capabilities of the steering robot.

"The automated steering machine shall be capable of supplying steering torques between 40 to 60 Nm (29.5 to 44.3 lb-ft). The steering machine must be able to apply these torques when operating with steering wheel velocities up to 1200 deg/sec."

However, the TP does not mention the steering wheel rotational acceleration capabilities, and even more importantly, the steering wheel acceleration limits that should be adhered to during the testing.

If the test conductor is not cautious and the steering velocity of 1200 deg/sec is reached too quickly this will result in high [rotational] acceleration values which theoretically could cause physical damage to the steering system.

What is more likely to occur though is that internal vehicle system safety checks will identify the high [rotational] acceleration inputs into the steering wheel as implausible, based on ISO26262 functional safety requirements. As a result, the ESC control module may consider the signal from the steering system is "out of range" not be trusted by the ESC module.

If there are no requirements/limits for the rotational acceleration described in the TP, this may cause test repeatability issues between the different testing facilities and even between NHTSA and OEMs.

Higher rotational steering input accelerations also have no impact on vehicle dynamics such as yaw rate. The vehicle experiences the same yaw rate regardless of the acceleration values as long as the sine with dwell profile is accomplished.

Similarly, the FMVSS performance requirements are solely based on yaw rate measurements after the sine with dwell maneuver.

In summary, excessive steering input rotational acceleration can cause potential damage to the steering system as well as potentially causing internal vehicle safety checks to flag the signal as invalid and will also likely cause repeatability issues between OEM testing and NHTSA testing without any additional benefit.

Recommendation:

Limit the maximum steering wheel input rotational acceleration that the steering robot outputs during the Sine with Dwell maneuver be limited to 30,000 deg/sec^2. This level of steering input rotational acceleration still exceeds what humans are capable of as well as what is necessary to complete the sine with dwell maneuver that the FMVSS requires.

Issue:

The procedure does say to stop testing if two-wheel lift occurs. If testing is stopped, then the test is considered a fail. FMVSS 126 and ECE R40H do not specify stopping testing if two-wheel lift occurs. Thus, there is an inconsistency between the test procedure and the regulation(s)

Recommendation:

Correct inconsistency with appropriate guidance.

FMVSS No. 135: Light vehicle brake systems

Issue:

In the subject notice, NHTSA indicated that it is requesting comment on whether the test procedure should be revised for clarity or efficiency. For example, one change might be a reduction in the number of stopping attempts for a specific test condition(s) if the performance requirements are met early in the test sequence.

Recommendation:

Innovators agrees that instead of completing the specified number of stopping attempts, once the performance requirements can be confirmed as being met, the test being conducted may be skipped. However, the minimum number of stopping attempts should be specified.

Issue:

FMVSS135 section S6.3.13 allows the brake burnish to be run for most electric vehicles in neutral, which limits regenerative braking. As a result, it can take an EV many thousands of miles of operation to reach a state of friction brake use equivalent to running a 200 stop burnish without regenerative braking.

Recommendations:

Change the regulation to do the burnishing in neutral or with the EV motor(s) engaged to accelerate the brake burnishing process.

FMVSS No. 141: Minimum sound requirements for hybrid and electric vehicles

Issue:

Current performance specification are not sufficiently repeatable and reproducible.

Recommendation:

1. Update FMVSS 141 to match ***current*** SAE J2889-1 criteria for background noise
2. Update FMVSS 141 to align with updated SAE J2889-1 (pending outcome of SAE Cooperative Research Program). J2889-1 will not be republished until later this year, at soonest.

FMVSS No. 201: Occupant protection in interior impact

Issue:

With the universal incorporation of FMVSS 226 compliant deployable upper interior head impact curtains, some of the FMVSS 201 head impact targets are redundant and could be deleted without reducing safety.

Recommendation:

Remove the regulatory requirement for the lateral test points covered by the deployed side curtain.

Issue:

Opaque head form makes accurate targeting difficult.

Recommendation:

Specify use of Transparent Head Form to increase accuracy of targeting.

Issue:

New / Enhanced safety sensor camera groupings require covers in headliner / windshield. These additional and / or larger covers cause difficulty locating Forwardmost point at centerline.

Recommendation:

Clarification needed in the test procedure. “The rear view mirror and CHMSL are currently excluded in the TP. The sensor groups (with or without covers) should also be excluded from the TP.”

Issue:

New / enhanced safety technology and new vehicle configurations which add components to the exterior roof of vehicle are causing difficulty locating outermost points 1, 2, and the A-pillar reference point (APR).

Recommendation:

Clarify test procedure. Exclude exterior roof mounted components that adversely impact locating points 1, 2, and the A-pillar reference point (APR).

Issue:

Filter used for HIC calculation not sufficiently specified.

Recommendation:

Specify that filters used for HIC calculation follow SAE Recommended Practice J211 dated March 1995.

Issue:

Certain FMH launch devices may exhibit excessive flexing which reduces the accuracy of the device.

Recommendation:

Develop equipment stiffness and calibration specification to prevent equipment flexing and improve launch accuracy of FMH (example FMVSS 226 deflection requirements).

Issue:

Free motion head form requirement Endevco 7264-2000 accelerometers are no longer widely available.

Recommendation:

Develop generic accelerometer/sensor performance specification.

Issue:

The Part 572 Free Motion Head Form design drawing is on paper. Standardization of CAD 3D head forms desired.

Recommendation:

Update Free Motion head form approved test device drawing package, from 1992 drawings to 3 Dimensional and CAD.

Issue:

FMVSS 201 requires multiple relocations for head-form contact at correct angle. Limit to 3 relocations for consistency. FMVSS S10 Target locations (c) “the radius of the sphere is increased by

25 mm increments until the sphere contains at least one point that can be contacted at one or more combination of angles." tp-201u-02_tag 2016.pdf

Recommendations:

Limit to 3 relocations for consistency, accuracy.

Issue:

Non-Standardization of Minimum Vertical Approach Angle Varies; A-Pillar it is -5 degrees and for other pillars is -10 degrees.

Recommendations:

Reconsider lower limit of back off angle for standardization.

FMVSS No. 202: Head restraints for passenger vehicles

FMVSS 202a

Issue:

S4.1 of the current standard provides manufacturer options to comply using either the S4.2 (Static) or S4.3 (Dynamic) test procedures. Currently, the OVSC spreadsheet does not provide a place to indicate which compliance options manufacturers choose for different seating options (e.g., bench vs. captain's chair) for each seating row. Currently many manufacturers simply annotate the spreadsheet to make this clarification.

Recommendation:

Innovators recommends that NHTSA add to the OVSC spreadsheet a place where manufacturers can select which compliance option they are testing to for various seating variants of an entire seat row.

FMVSS No. 203: Impact protection for the driver from the steering control system

Issue:

The Test Procedure has not been updated with the current S2 Application requirements.

Excerpt FMVSS 203 - "S2 Application. This Standard …. However, it does not apply to vehicles that conform to the frontal barrier crash requirements (S5.1) of Standard No. 208 (49 CFR 571.208) by means of other than seat belt assemblies. It also does not apply to walk-in vans."

Excerpt tp-203-02_1990.pdf - "2 GENERAL REQUIRMENTS …… It does not apply to vehicles with air bags or walk-in vans. Forward control vehicles that do not meet the requirements of FMVSS 203 must have a Type 2 seat belt that conforms to FMVSS 209 installed for the driver."

Recommendations:

Update Tp-203-03 to reflect current FMVSS S2 Application.

FMVSS No. 204: Steering control rearward displacement

Issue:

NHTSA test procedure references outdated photo documentation (i.e., strobe lights, 16mm film, scratch tubes).

Recommendations:

Make the photo documentation specification technology neutral.

FMVSS No. 205: Glazing materials

Issue:

Rigid plastic glazing is currently only allowed in certain vehicle locations due to the technology that was available when the regulation was updated (1996). The SAE Glazing Committee that is responsible for the maintenance and update of ANSI Z26.1. has recently published a revision to this document (Z26.1-2019/SAE J3097 May 2019) that expands the use of rigid plastic glazing for side and rear windows.

Recommendation:

Update FMVSS 205 to permit rigid plastic glazing for side and rear windows that meet the S4.2 Item 1, and 2 glazing requirements.

FMVSS No. 207: Seating systems

Issue:

In the static force test, it specifies the application of a horizontal force equal to 20 times the weight of the seat and it's illustrated at Figure 1-3 in the regulatory text as below.

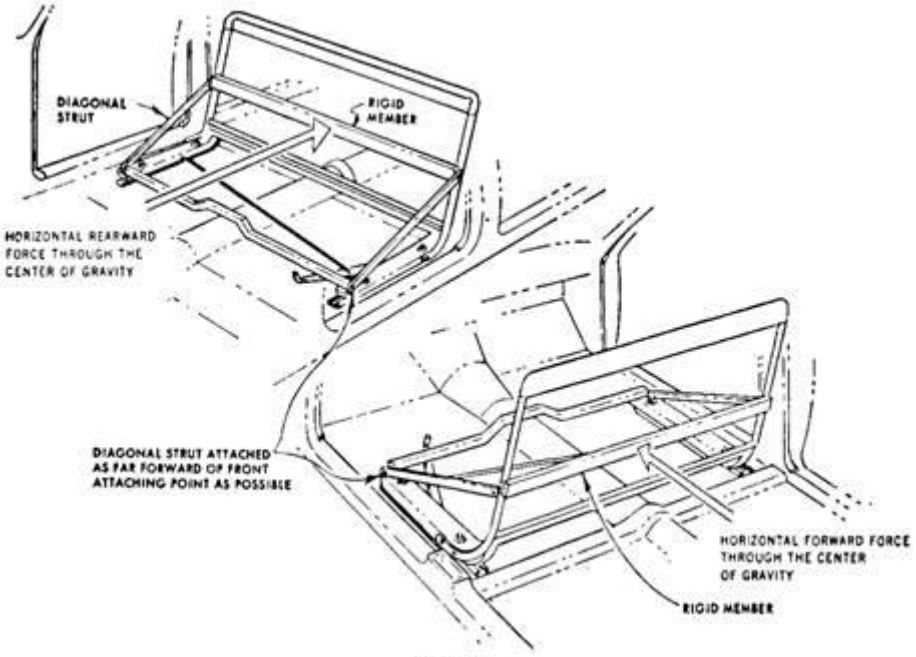

FIGURE 1

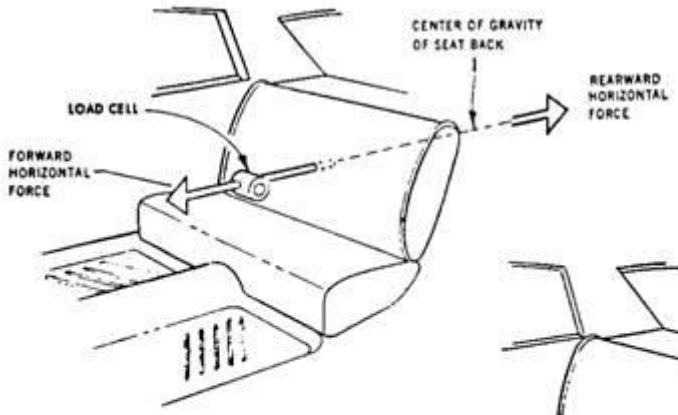

FIGURE 2

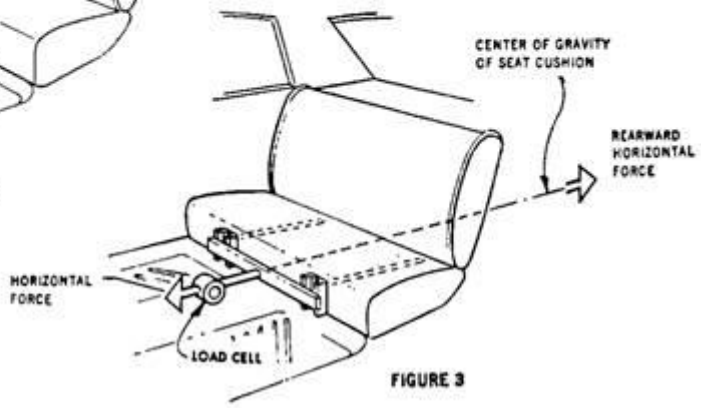

FIGURE 3

However, there is no detailed procedure/limits to ensure the force is applied horizontal.

In reality, a testing laboratory applied a force obliquely in a compliance test (see example - for 2010 Nissan Cube).

FIGURE 31. Forward Load on Seat Back, P4, Pre-Test

https://static.nhtsa.gov/odi/ctr/2010/TRTR-641379-2010-001.pdf

Recommendation:

Add a test procedure to ensure that the direction of force application is horizontal.

FMVSS No. 208: Occupant crash protection

Issue:

For both FMVSS 208 and 214 the compliance test procedures do not prescribe how/where the test device umbilical cables should be routed. In practice, the umbilical is routed inboard as a "standard practice" (though undocumented). If the umbilical cord is routed inboard, it may make contact with the seatbelt latch plate and/or buckle and could have a negative/non-biofidelic influence on the system during the test.

Recommendations:

Update test procedure to allow alternate ATD umbilical routing to reduce the possibility of inappropriate contact with seatbelt latch plates and/or buckles.

Issue:

There are several inconsistencies in the fueling filling requirements between FMVSS 208, 214, and 301 as well as between the test procedure and the standard itself. Given the fact that FMVSS 301 is often tested as part of FMVSS 208 and 214 crash tests, the fuel capacity requirements and test procedures should be aligned.

The following is a table illustrating these differences.

FMVSS	TP#	Capacity Provisions
FMVSS 208	FY TP208-14	Reg S8.1.1(c): 92-94% of usable capacity TP 208 Data Sheet 32: 94% of usable capacity
FMVSS 214	FY TP214D-09 FY TP214P-01	214 Regulation S8.1: 92 to 94% of usable capacity TP214D 12(B)(3): 92 to 94% of usable capacity TP214P 12.1(B)(3): 92 to 94% of usable capacity
FMVSS 301	FY TP301-04	301 Regulation S7.1.1: 90 to 95% of (total) capacity TP301 12.1(A): 92 to 94% of usable capacity TP301 Data Sheet 2: 91 to 94% of usable capacity

Recommendation:

Align FMVSS 208, 214, and 301 requirement and test procedure fuel fill capacities to be consistent at 92 to 94% of usable capacity.

Issue:

Crash test condition in S5.2 Lateral specifies an out-of-date version of the lateral barrier.

S5.2 Lateral moving barrier crash test. Impact a vehicle laterally on either side by a barrier moving at 20 mph under the applicable conditions of S8. The test dummy specified in S8.1.8 positioned in the front outboard designated seating position adjacent to the impacted side shall meet the injury criteria of S6.2 and S6.3 of this standard.

Recommendation:

Revise standard to incorporate an updated lateral barrier (Innovators to provide recommendation for correct barrier in supplemental submission)

Issue:

Crash condition specified in S5.3 is non-repeatable, and OEMS do not subject their vehicles to S5.1 because vehicles must also meet rollover (specified in S5.3).

S5.3 Rollover. Subject a vehicle to a rollover test in either lateral direction at 30 mph under the applicable conditions of S8 of this standard with a test dummy specified in S8.1.8 placed in the front outboard designated seating position on the vehicle's lower side as mounted on the test platform. The test dummy shall meet the injury criteria of S6.1 of this standard.

Recommendation:

Eliminate S5.3 since it is not repeatable or reproduceable.

Issue:

For light vehicles between 8500 GVWR and 10,000 GVWR, two main options are available. One is to meet injury criteria in all FMVSS 208 crash tests, belted and unbelted with the 50th Hybrid III ATD (Section 5.1), and the other option is to meet FMVSS 209. However, optimum load limiting is not possible if FMVSS209 is chosen as the compliance option.

Recommendation:

Adopt EU R16 as an alternate compliance option for vehicles between 8500 to 10000 GVWR. Alternatively, NHTSA could harmonize with CMVSS 209 which does not require the static elongation test if vehicle is equipped with frontal airbags. These alternatives would apply to buses, trucks and MPV's.

Issue:

There are miscellaneous aspects of FMVSS 208 that should be clarified/revised.

Recommendation:

Remove and archive sections, such as S4.1.1, S4.1.3, and S4.1.4 that refer to obsolete/historical manufacturing dates.

Update tools to use tilt sensors for the head and pelvic angles, similar to what is done for the ES-2re in Section S12.2.1 (b)(1) of the FMVSS214. The tilt sensors provide a more accurate value and reduce the potential for user error from the inclinometer and hip probe.

Clarify the seat position.

> *Section S8.1.2 Adjustable seats are in the adjustment position midway between the forwardmost and rearmost positions, and if separately adjustable in a vertical direction, are at the lowest position. If an adjustment position does not exist midway between the forwardmost and rearmost positions, the closest adjustment position to the rear of the midpoint is used.*

The seat travel is different for different protocols in various FMVSS; some use track travel and others utilize the full seat travel window to determine mid fore/aft travel. Update the protocol to indicate mid of full seat travel window or mid of track travel.

FMVSS No. 209: Seat belt assemblies

Issue:

FMVSS 209 quasi-static belt elongation tests do not comprehend the effects of dynamic pre-tensioning systems. As a result, this provision inhibits the ability to fully utilize pre-tensioning and load-limiting technologies. While a dynamic test would be the most appropriate for realizing the full benefits of these technologies, as a simple (but limited) step in the correct direction, the test procedures should be modified to permit activation of the pre-tensioner before conducting the quasi-static test.

Recommendation:

Modify test procedure to permit firing of the pre-tensioner before conducting the quasi-static test.

Issue:

On August 10, 2015, the Automotive Safety Council (ASC), formally known as the Automotive Occupant Restraints Council (AORC), Alliance of Automobile Manufacturers (Alliance), and the Association of Global Automakers (Global Automakers) jointly petitioned the agency to modify the amend FMVSS 209, Seat Belt Assemblies S4.2 (e) *Requirements for webbing, Resistance to light,* S5.1 (e) and the associated TP-209-08, Laboratory Test Procedure Section A.4, Resistance to Light [S4.2 (e), S5.1 (e)] to include Xenon Arc light exposure as an equivalent alternative test methodology to the current Carbon Arc light exposure with no other changes to the requirements for seat belt webbing performance.

The conditions that prompted this petition have only become more important with time as the current Carbon Arc test equipment is no longer being produced and supplies of carbon rods becoming increasingly difficult to obtain.

Recommendations:

Add a compliance option to use Xenon Arc light as an option to Carbon Arc light. Specific technical details and reg text recommendations detailed in Appendix B.

FMVSS No. 210: Seat belt anchorages

Issue:

Innovators notes that the current body block positioning procedures introduce significant test variability and are currently a subject of rulemaking (RIN 2127-AL05).

The Alliance of Automobile Manufacturers in its 2015 comments (NHTSA-2012-0036-0025) and reiterated in its 2018 comments (NHTSA-2012-0025), recommended using the current two-piece body block with the UNECE R14 positioning procedures.

In addition, as part of the TTIP trade harmonization activity the EU compared the levels of safety between FMVSS 210 and R14 and determined that they were functionally equivalent[1].

In this report the EU concluded:

> *"Stemming from the comparison between FMVSS 210/207 and UNECE Regulation No 14 as contained in this document, both FMVSS 210/207 and UNECE Regulation No 14 have proven to be working well with respect to the practical performance of seat belt anchorage systems in real world passenger car collisions. This is supported by the literature research under item 4 providing no evidence of real-world cases, the item 5 in-depth analysis of EU accidents and the assumption that there is no US in-depth accident data that would point in the direction that there is a potential problem with seat belt anchorages that were certified according to FMVSS 210/207."*

Recommendation:

Innovators agrees with the prior Alliance comments and believes that, given the EU determination that FMVSS 210 and R14 provide equivalent safety assurance, NHTSA should harmonize its seat belt anchorage strength and strength testing requirements with R14.

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[1] EU POSITION PAPER – TEST CASE ON FUNCTIONAL EQUIVALENCE PROPOSED METHODOLOGY FOR AUTOMOTIVE REGULATORY EQUIVALENCE - Tabled for discussion with the US in the negotiating round of 29 September-3 October 2014 and made public on 7 January 2015.

FMVSS No. 212: Windshield mounting

Issue:

Section S6.1(a) - Each dummy is restrained only be means that are installed for protection at its seating position.

Section S6.1(a) suggest that all FMVSS 212 tests should be conducted with all installed active/passive restraints.

Recommendation:

Clarify whether FMVSS 212 applies to unbelted occupants that may only have a supplemental inflatable restraint (SIR) or should all available restraints (SIR/Belt) be used during FMVSS 212 testing.

FMVSS No. 214: Side impact protection

Issue:

The test procedure does not specify the exact locations of the ballast weight when needed to meet test weight. The ballast is intended to replicate cargo weight, but Innovator members have observed tests where the ballast weight was mounted to the floorboard in the second row seating positions. This can affect the moment of inertia of the vehicle and influence the dynamics of the crash. This effect was observed in an NCAP MDB test but would also occur in FMVSS 214 compliance tests.

Recommendation:

Test procedures should specify that test ballast weight be secured in the vehicle's cargo compartment.

Issue:

The static door beam requirements are redundant and potentially design restrictive.

Recommendation:

Eliminate the static side pole test requirement.

The static test in the FMVSS 214 was adopted years before any dynamic tests with side impact ATD's were adopted in the regulation. Since the dynamic FMVSS 214 moving deformable barrier test required meeting injury criteria for the front and rear outboard seated ATD's, the strength of the entire vehicle side structures was increased far beyond that needed to meet the static pole test. The overall side structure strength and stiffness was further increased with the introduction of the IIHS MDB side impact test and the subsequent introduction of the oblique pole test in the

FMVSS214. We believe that the static pole test in the current FMVSS214 is no longer relevant in real world safety and should be discontinued. The results of an ongoing study conducted for NHTSA by George Mason University was presented by Reichert et al. at the 2021 SAE Govt./Ind. Meeting. Although, the study is still continuing, the results show that non-compliance in the Static Pole test in FMVSS 214 has little or no effect on occupant responses in the dynamic oblique pole test or the Movable Deformable Test. An earlier NHTSA study by Kahane[1] has also shown that while the Static Pole Test was somewhat effective in pole crashes but was not effective in multi-vehicle crashes.

[1]Kahane, C. J. (2004, October). *Lives saved by the Federal Motor Vehicle Safety Standards and other vehicle safety technologies, 1960-2002*. (Report No. DOT HS 809 833). Washington, DC: National Highway Traffic Safety Administration. Available at www-nrd.nhtsa.dot.gov/Pubs/809833.PDF.

Issue:

Automatic door lock (ADL)requirements are not consistent between NCAP (allows doors to be locked if vehicle is equipped with ADL) and FMVSS 214 (doors unlocked).

Recommendation:

Modify FMVSS 214 to permit doors to be locked if the vehicle is equipped with ADL.

Issue:

Test Weight range FMVSS214 - For the vehicle target weight (range of tolerance) there seems to be a typographical error for FMVSS214 Test procedure – please see below:

Test Procedure:

12. TEST EXECUTION.....Continued

D. DETERMINE THE "AS TESTED" WEIGHT AND ATTITUDE

Determine the actual weight and attitude of the test vehicle in its "as tested" condition. The "as tested" condition represents the actual test weight and attitude of the test vehicle prior to impact. It includes the weight of all instrumentation, onboard cameras, lighting equipment, test dummy and umbilical cords, etc.

The weight of the test vehicle in the "as tested" condition must lie within the required weight range (i.e., calculated test target weight – 4.5 kg to 9 kg). The attitude of the test vehicle in the "as tested" condition must lie between the "as delivered" attitude and "fully loaded" attitude, inclusive. Record the weight of the ballast added to the test vehicle and any vehicle parts removed from the test vehicle to achieve the "as tested" condition. (See Check Sheet No. 2)

Check sheet:

CHECK SHEET NO. 2 (Continued)
Determine the Vehicle Test Weight and Attitude

__**6** **Determine the "As Tested" Weight**
__6.1 With the vehicle in the Fully Loaded Weight condition, drain transmission fluid, engine coolant, motor oil, and windshield washer fluid.
__6.2 Remove the RCLW from the cargo area
__6.3 Secure instrumentation, equipment and cameras to the test vehicle.
__6.4 Weigh the vehicle at each wheel and add together to determine the "As Tested Weight". Record the weight measurements on the "Vehicle Weight" table below.
__6.5 If necessary, add ballast to achieve an As Tested Weight that falls within the required weight range (TVTW – 4.5kg to TVTW – 9 kg).

Recommendation:

Change the test procedure documents to correct the apparent typo.

Issue:

Seat position standardization would improve accuracy.

Recommendation:

Clarify the seat position.

> S8.3.1.3.2 Using only the control that primarily moves the seat fore and aft, move the seat cushion reference point to the mid travel position. If an adjustment position does not exist midway between the forwardmost and rearmost positions, the closest adjustment position to the rear of the midpoint is used.

The seat travel is different for different protocols; some use track travel and others utilize the full seat travel window to determine mid fore/aft travel. Update the protocol to indicate mid of full seat travel window or mid of track travel. Reference in TP214D-09_APP_B_CHECKSHEETS, Check sheet 8, page 21.

FMVSS No. 217: Bus emergency exits and window retention and release.

Issue:

FMVSS 217 S5.1 window retention requirement was promulgated before FMVSS 226 Ejection mitigation was developed and implemented. Given the implementation of FMVSS 226, the 217 S5.1 requirement became redundant since the FMVSS 226 requirements address the same aspect of performance; ejection mitigation.

Recommendation:

Innovators request that NHTSA updates FMVSS 217 Bus Emergency Exits and Window Retention and Release to exempt a bus from the requirements of section S5.1 Window Retention if the vehicle complies with FMVSS 226 Ejection Mitigation.

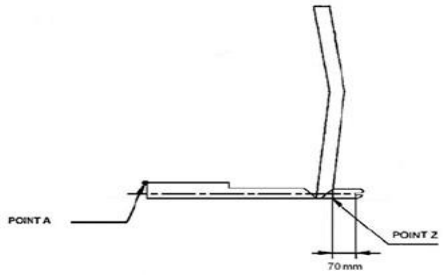
As mentioned above, one of the purposes of FMVSS 217 is to "…to minimize the likelihood of occupants being thrown from the bus…", and vehicles that meet the requirements of FMVSS 226 fulfill that purpose; thereby, superseding the need for FMVSS 217 S5.1 Window Retention. Additionally, Innovators recommend that the proposed exemption include vehicles over 10,000 lbs GVWR if a manufacturer voluntarily meets the requirements of FMVSS 226, i.e., the applicability of FMVSS 226 is 10,000 lbs GVWR or less.

FMVSS No. 225: Child restraint anchorage systems

Issue:

TP-225-01 - Regarding S9.2.2(a), the direction of force applied to the CRF is not clear. ("horizontal" or "parallel to the bottom surface of the CRF")

Figure 10 for the test procedure (below), specifies the location where the 100 N load is to be applied. However, it does not clearly specify the direction.

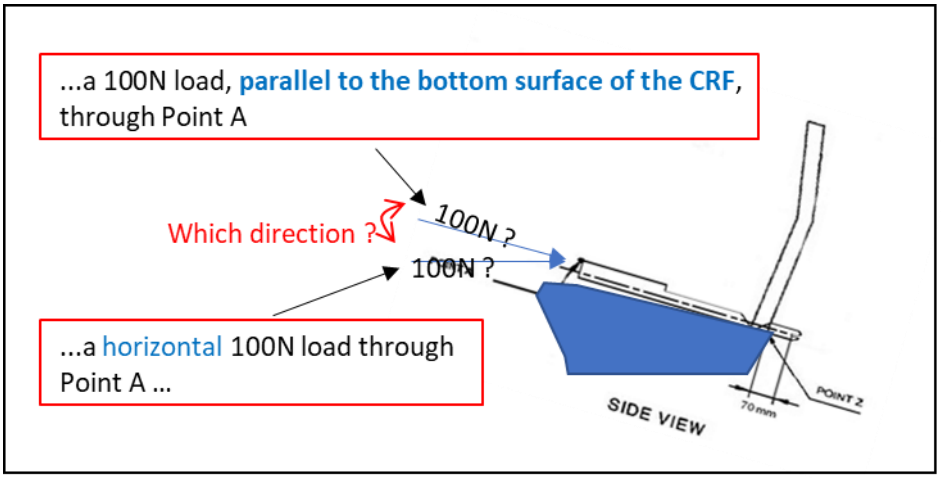


SIDE VIEW

Figure 10 – Side View of CRF showing Point A and Point Z

Apply and maintain a 100 N load to the CRF through Point A of the CRF using a force gauge. Using either measuring scales incorporated into the CRF or appropriate measuring tapes, measure parallel to the bottom surface of the CRF, the distance between Point Z of the CRF and the vertical transverse plane tangent to the front surface of the anchor bar. Record the distance on Data Sheet 4.

For many vehicles placement of the CRF to the seat pan results in an orientation as shown in the figure below. In this illustration, it is clear that there are two reasonable directions in which the 100 N load can be applied.



Recommendation:

In order to clarify the direction of force application, we recommend that the first sentence in the figure 10 be modified to state: "Apply and maintain a 100 N load, parallel to the bottom surface of the CRF, through Point A ...

If this load application is not what the agency intends, the statement could be modified to state: "Apply and maintain a horizontal 100N load through Point A ...

FMVSS No. 225: Child restraint anchorage systems

Issue:

Regarding 'S6.2 Location of the tether anchorage', .

Test procedure (TP-225-01) describes the usage of 2D template for deciding the location of tether anchorage as below.

Place the SAE J826 two-dimensional drafting template on the seat such that the H-point of the SAE J826 two-dimensional drafting template coincides with the SgRP of the DSP being checked. The SAE J826 two-dimensional drafting template shall be in the vertical longitudinal plane through the seating reference point.

However, it's difficult for the H-point to accurately coincide with the SgRP by using 2D template, because the 2D template must be keeping pushed into the seat.

Therefore, in reality, a gap typically occurs between the H-point and SgRP.

In order to ensure accurate measurement, the J826 3D-Dummy should be used same as other regulations, such as in FMVSS202a.

Recommendation:

Use J826 3D-Dummy (or SAE J4002 as discussed in the Multiple Standards section) instead of 2D template in S6.2 Location of the tether anchorage.

Provide 4-yr lead-time/optional compliance to address current vehicle certifications.

FMVSS No. 305: Electric-powered vehicles: Electrolyte spillage and electrical shock protection

Issue:

TP-305-01 – The primary issue is that the physical barrier protection requirements specified in S5.3(c) are not included in TP-305-01. As such it seems that there might be the possibility that a test laboratory may conduct S5.3 *Electrical Safety* test to requirements of S5.3(a) or S5.3(b) only, even if a vehicle model has been certified according to S5.3(c). For the sake of laboratory safety, we also recommend reconsidering the conditions for the measurements for physical barrier protection S5.3(c) in the static rollover test. Adopting different test conditions could reduce or eliminate the need for an individual to maneuver around the static rollover machine to conduct measurements as the vehicle is rotated by 90-degree increments.

Recommendation:

First, update the laboratory test procedure (TP-305-01) to add in test procedures and requirements to support the physical barrier option (S5.3(c)) and revise to the following. We recommend taking the physical barrier protection measurements when the vehicle is stationary and at 0 degrees in both the X- and Y- planes before mounting the vehicle on the static rollover machine. Confirm there is no direct contact under the protection degree IPXXB. As the vehicle is rotated to test for electrolyte leakage (which is a separate requirement), the target area for physical barrier protection can be observed when the vehicle is rotated at 90-, 180-, and 270-degrees as photographic documentation is required. If there is no physical change to the target area, the vehicle would be deemed to be in compliance.

Part 572: Anthropomorphic Test Device

General Recommendation:

NHTSA should consider revising how they provide access to and organization of documents on their website. We recommend a system/format similar to that used by EuroNCAP, including archiving of old documents/revisions.

The NHTSA website should contain drawing package(s) and CAD models of all non-proprietary components (e.g. including structural replacements but not Load Cells), as was similarly done for THOR-50M.

NHTSA should consider establishing an accepted supplier list, similar to ENCAP's TB029. This would not be an endorsement of any particular supplier, but rather an opportunity for test labs to make decisions based on what suppliers (or mix thereof) that NHTSA labs use; The use of which harmonized parts should be transparent; The NHTSA form that specifies is a H3-5th is FTSS/Denton should be updated.

Test Equipment Recommendations:

Unless a technical reason is identified, NHTSA should reuse existing impactors before creating new and unique designs for ATD certification tests. Example: WSID arm impact proposed thru ISO WSID task group.

NHTSA should consider eliminating the less than 5% of total mass for attachments requirement. If these attachments are rigidly mounted, they should be considered as part of the impactor body and not attachments. There are cases, e.g. for smaller child impactors, that this design requirement can become critical, driving the use of smaller diameter suspension cables.

The agency should consider eliminating the inclusion of 1/3 cable mass into impactor requirement. Rather, consider setting a cable diameter range that will be consistent across labs and that portion of mass will also be inherently consistent. Along with the 5% attachment mass requirement, efforts have been common to reduce the diameter of the suspension cables. While they are sufficiently strong to carry the load, cable stretch can become significant (and unnoticed) leading to increased test variation as the impactor does not impact the target where intended. Suspension cable diameter should be increased.

The agency should avoid mass requirements that cannot be simply measured/verified, i.e. 1/3 mass of impactor suspension cables; or Lower 1/3 mass of Foot Impact Rigid Pendulum Assembly.

Recommendations Applicable to Multiple ATD's:

Consider specifying the use of ball bearing knee sliders

J211 and other SAE references need to be updated/referenced in NHTSA Lab Test Procedures. Unfortunately, some of the current references are sorely out of date, or "living" documents from SAE/ISO that do not provide enough clarity to resolve all questions in the test procedures.

APPENDIX B

Technical Details from August 15, 2015, ASC, Alliance, and Global Automakers Petition to Amendment – FMVSS No. 209 – Seat Belt Assemblies and TP-209-08 Laboratory Test Procedure to add Xenon Arc light test as an option to Carbon Arc Light test

Request for Amendment to Rule – FMVSS209 – Seat Belt Assemblies and TP-209-08 Laboratory Test Procedure

FMVSS209 S4.2 (e) currently states:

(e) *Resistance to light.* The webbing in a seat belt assembly after exposure to the light of a carbon arc and tested by the procedure specified in S5.1(e) shall have a breaking strength not less than 60 percent of the strength before exposure to the carbon arc and shall have a color retention not less than No. 2 on the AATCC Gray Scale for Evaluating Change in Color (incorporated by reference, see § 571.5).

FMVSS209 S5.1 (e) currently states:

(e) *Resistance to light.* Webbing at least 508 mm in length from three seat belt assemblies shall be suspended vertically on the inside of the specimen track in a Type E carbon-arc light exposure apparatus described in ASTM G23–81 (incorporated by reference, see § 571.5), except that the filter used for 100 percent polyester yarns shall be chemically strengthened soda-lime glass with a transmittance of less than 5 percent for wave lengths equal to or less than 305 nanometers and 90 percent or greater transmittance for wave lengths of 375 to 800 nanometers. The apparatus shall be operated without water spray at an air temperature of 60° +/-2 °Celsius (°C) measured at a point 25 +/-5 mm outside the specimen rack and midway in height. The temperature sensing element shall be shielded from radiation. The specimens shall be exposed to light from the carbon-arc for 100 hours and then conditioned as prescribed in paragraph (a) of this section. The colorfastness of the exposed and conditioned specimens shall be determined on the AATCC Gray Scale for Evaluating Change in Color (incorporated by reference, see § 571.5). The breaking strength of the specimens shall be determined by the procedure prescribed in paragraph (b) of this section. The median values for the breaking strengths determined on exposed and unexposed specimens shall be used to calculate the percentage of breaking strength retained.

TP-209-08 currently states:

(4) Resistance to Light

(a) Light exposure (carbon-arc), 100 hours

(b) Perform breaking strength test

(c) Calculate percentage breaking strength retained

NOTE: Must retain a minimum of 60% of median breaking strength calculated in A.3(d), Webbing Breaking Strength

A.4 Resistance to Light [S4.2(e), S5.1(e)]

Webbing samples at least 508 mm in length from three seat belt assemblies shall be suspended vertically on the inside of the specimen rack in a Type E carbon-arc light-exposure apparatus described in Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials, ASTM Designation: G23-81, published by the American Society for Testing and Materials, except that the filter used for 100 percent polyester yarns shall be chemically strengthened soda-lime glass with a transmittance of less than 5 percent for wavelengths equal to or less than 305 nanometers and 90 percent or greater transmittance for wave lengths of 375 to 800 nanometers. The apparatus shall be operated without water spray at an air temperature of 60 ± 2°C measured at a point 25 ± 5 mm outside the specimen rack and midway in height. The temperature sensing element shall be shielded from radiation. The specimen shall be exposed to light from the carbon-arc for 100 hours and then conditioned as prescribed in paragraph A.1 of this section. The breaking strength of the specimens shall be determined by the procedure prescribed in paragraph A.3 of this section. The median values for breaking strengths determined on exposed and unexposed specimens shall be used to calculate the percentage of breaking strength retained. After exposure to light of a carbon arc, the webbing in a seat belt assembly shall have a median breaking strength not less than 60 percent of the median breaking strength and have a color retention of not less than Number 2 on the Geometric Gray Scale published by the AATCC.

Proposed change to each section is as follows:

FMVSS209 S4.2 (e) proposal:

(e) *Resistance to light.* The webbing in a seat belt assembly after exposure to the light of a carbon arc **or the light of a xenon arc** and tested by the procedure specified in S5.1(e) shall have a breaking strength not less than 60 percent of the strength before exposure to the carbon arc **or xenon** arc and shall have a color retention not less than No. 2 on the AATCC Gray Scale for Evaluating Change in Color (incorporated by reference, see § 571.5).

FMVSS209 S5.1 (e) proposal:

(e) *Resistance to light.* Webbing at least 508 mm in length from three seat belt assemblies shall be suspended vertically on the inside of the specimen track in a Type E carbon-arc light exposure apparatus described in ASTM G23–81 (incorporated by reference, see § 571.5), except that the filter used for 100 percent polyester yarns shall be chemically strengthened soda-lime glass with a transmittance of less than 5 percent for wave lengths equal to or less than 305 nanometers and 90 percent or greater transmittance for wave lengths of 375 to 800 nanometers. The apparatus shall be operated without water spray at an air temperature of 60° +/-2 °Celsius (°C) measured at a point 25 +/-5 mm outside the specimen rack and midway in height. The temperature sensing element shall be shielded from radiation. The specimens shall be exposed to light from the carbon-arc for 100 hours and then conditioned as prescribed in paragraph (a) of this section. The colorfastness of the exposed and conditioned specimens shall be determined on the AATCC Gray Scale for Evaluating

Change in Color (incorporated by reference, see § 571.5). **Alternatively, for Xenon Arc light exposure, apparatus described in ISO 105-B02 2013-05-15 until exposure produces a contrast equal to grade 4 on the grey scale on standard Blue Dye No. 7.** The breaking strength of the specimens shall be determined by the procedure prescribed in paragraph (b) of this section. The median values for the breaking strengths determined on exposed and unexposed specimens shall be used to calculate the percentage of breaking strength retained.

TP-209-0X proposal: [page 16]

(4) Resistance to Light

(a) Light exposure (carbon-arc, 100 hours) **or (xenon arc, until exposure produces a contrast equal to grade 4 on the grey scale on standard Blue Dye No. 7)**

(b) Perform breaking strength test

(c) Calculate percentage breaking strength retained

NOTE: Must retain a minimum of 60% of median breaking strength calculated in A.3(d), Webbing Breaking Strength

A.4 Resistance to Light [S4.2(e), S5.1(e)]

Webbing samples at least 508 mm in length from three seat belt assemblies shall be suspended vertically on the inside of the specimen rack in a Type E carbon-arc light-exposure apparatus described in Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials, ASTM Designation: G23-81, published by the American Society for Testing and Materials, except that the filter used for 100 percent polyester yarns shall be chemically strengthened soda-lime glass with a transmittance of less than 5 percent for wavelengths equal to or less than 305 nanometers and 90 percent or greater transmittance for wave lengths of 375 to 800 nanometers. The apparatus shall be operated without water spray at an air temperature of 60 ± 2°C measured at a point 25 ± 5 mm outside the specimen rack and midway in height. The temperature sensing element shall be shielded from radiation. The specimen shall be exposed to light from the carbon-arc for 100 hours and then conditioned as prescribed in paragraph A.1 of this section. **Alternatively, for Xenon Arc light exposure, apparatus described in ISO 105-B02 2013-05-15, until exposure produces a contrast equal to grade 4 on the grey scale on standard Blue Dye No. 7.** The breaking strength of the specimens shall be determined by the procedure prescribed in paragraph A.3 of this section. The median values for breaking strengths determined on exposed and unexposed specimens shall be used to calculate the percentage of breaking strength retained. After exposure to light of a carbon arc **or xenon arc**, the webbing in a seat belt assembly shall have a median breaking strength not less than 60 percent of the median breaking strength and have a color retention of not less than Number 2 on the Geometric Gray Scale published by the AATCC.

Rationale for change:

In December 2008, the Automotive Occupant Restraint Council (now ASC) submitted a "Request for Amendment to Rule" with respect to FMVSS209 that included a similar request for change to FMVSS 209. To date, no change to FMVSS209 regarding Light Exposure testing has been issued.

Many, if not all, webbing manufacturers and test facilities have been using the Atlas brand carbon arc light exposure equipment since the release of FMVSS 209. Much of this equipment is still in use but is very old. Atlas has sent all equipment users letters over the last couple of years about difficulty with supplying replacement or maintenance parts and finally a letter ending Atlas support for this equipment as of January 2016. (see attachment in Appendix 1 for three different communications from Atlas).

Other Carbon Arc light exposure equipment is available from different manufacturers, but not all equipment available is capable of performing the test required in FMVSS209.

Current ECE R16 Seat Belt Assembly test requirements also include a light exposure test requirement for seat belt webbing. The light source used in the ECE R16 testing is a Xenon Arc light source. Many OEM Automobile Manufacturers also specify the use of a Xenon Arc light source for their light exposure testing of webbing (in addition to the FMVSS209 required Carbon Arc light source testing). For global market vehicles, OEM manufacturers have to perform both FMVSS and ECE certification testing to demonstrate compliance so are doing both tests currently. (see attachment in Appendix 4 for summary of light exposure tests and equipment. See Appendix 5 for summary of various Customer requirements).

By including Xenon Arc light exposure testing (as currently specified and performed in ECE R16) as an acceptable alternative to the current Carbon Arc light exposure testing in FMVSS 209, with no change in webbing performance requirements currently in FMVSS 209 after this light exposure, the NHTSA would accomplish several things…

1) An opportunity to work toward a harmonization with ECE R16 webbing light exposure test requirements with respect to FMVSS 209 webbing light exposure test requirements. The NHTSA has stated its desire to work toward harmonizing global test requirements.

2) Since no changes to the requirements for webbing performance after either Carbon Arc or Xenon Arc light exposure are being proposed, there is no degradation to the performance requirement in FMVSS 209.

3) Including both Carbon Arc and Xenon Arc light exposure requirements will allow owners of existing Carbon Arc test equipment to continue using that equipment until it is no longer viable, but allow owners of older Carbon Arc test equipment the option to buy new Xenon Arc test equipment at their choosing in the most time efficient and cost efficient manner if their current equipment has reached its end of life.

4) It will provide a reduction in effort and cost for automotive Customers, seat belt and webbing suppliers and test labs in that only one set of light exposure test equipment will be required to perform FMVSS209, ECE R16 regulatory testing and OEM Customer

performance specification testing for light exposure test requirements for seat belt webbing.

Current ECE R16 webbing light exposure test requirements states:

7.4.1.2. Light-conditioning

7.4.1.2.1. The provisions of Recommendation ISO 105-B02 (1994/Amd2:2000) shall apply. The strap shall be exposed to light for the time necessary to produce a contrast equal to Grade 4 on the grey scale on Standard Blue Dye No. 7.

Supporting evidence:

Since seat belt webbing suppliers provide webbing for seat belt assembly products used in both the United States, certified to the requirements of FMVSS 209, as well as seat belt assembly products used in other global markets, certified to the requirements of ECE R16, test data for webbing tested to both requirements, including light exposure testing by Carbon Arc and Xenon Arc test equipment is available for comparative review and analysis. (see attachment in Appendix 6 for webbing test results from multiple webbing suppliers).

In general, the test results between Carbon Arc and Xenon Arc light exposure testing is comparable with the Xenon Arc test result being just a bit more severe with webbing tensile test results for the Xenon Arc exposed samples being a few percentage points lower than samples exposed to Carbon Arc light, but with both sets of post-light-exposure samples far exceeding the minimum strength required in FMVSS 209. There is no request being made to change the post light exposure tensile strength requirement for webbing.

See attachment in Appendix 7 for a simplified comparison between sunlight, Carbon arc and Xenon Arc light exposure.

This request:

This request is to add the webbing Xenon Arc light exposure test requirement currently found in ECE R16 as an acceptable alternate to the current Carbon Arc light exposure test required in FMVSS 209.

Implementation:

The proposed implementation strategy is to immediately implement into FMVSS 209 and TP-209 upon final agency review and request for comments. Immediate implementation is requested for several reasons:

1) No change to the actual post-light-exposure test requirement found in FMVSS 209 is being made or requested.

2) Current Carbon Arc test equipment is beginning to reach end of life. Manufacturer support for this equipment will end January 2016 and replacement parts and test

consumables are and will continue to be harder to find. Immediate implementation may prevent an interruption in testing.

3) The Xenon Arc light exposure test equipment is currently available and being used for ECE R16 certified product and has proven to be a reliable and repeatable test based on user feedback. Inclusion of a Xenon Arc light exposure device in FMVSS209 would insure no disruptions due to Carbon Arc test equipment failure. No added work or costs to certify seat belt webbing product would be required since in most cases it's already being done.

In conclusion, the Automotive Safety Council would like to thank the National Highway Safety Traffic Administration for consideration of this request to amend a requirement in FMVSS209. Due to the urgency of the current situation, with current Carbon Arc light exposure test equipment at risk of immediate or unexpected failure due to age, lack of replacement parts / test consumables, or support from the equipment manufacturer, we would like to request an immediate review of this request.

Appendix C

Recommended Mark Up of FMVSS No. 104 Reg Text

§ 571.104 Standard No. 104; Windshield wiping and washing systems.

S1. *Scope.* This standard specifies requirements for windshield wiping and washing systems.

S2. *Application.* This standard applies to passenger cars, multipurpose passenger vehicles, trucks, and buses.

S3. *Definitions.* The term *seating reference point* is substituted for the terms *manikin H point, manikin H point with seat in rearmost position* and *H point* wherever any of these terms appear in any SAE Standard or SAE Recommended Practice referred to in this standard.

~~*Daylight opening*~~ *Design Glass Outline* means the maximum unobstructed opening through the glazing surface, as defined in paragraph ~~2.3.12 of section E, "Ground Vehicle Practice," of SAE Aerospace-Automotive Drawing Standards (1963)~~ 3.3.7 SAE J1100 " Motor Vehicle Dimension" (November 2009) (incorporated by reference, see § 571.5).

Glazing surface reference line means the line resulting from the intersection of the glazing surface and a horizontal plane 635 millimeters above the seating reference point, as shown in ~~Figure 1~~ Figure 6 of SAE Recommended Practice ~~J903a (1966)~~ J903 (xxx 2021) (incorporated by reference, see § 571.5).

Overall width means the maximum overall body width dimension "W116", as defined in ~~section E, "Ground Vehicle Practice," of SAE Aerospace-Automotive Drawing Standards (1963)~~ Table 24 SAE J1100 " Motor Vehicle Dimension" (November 2009) (incorporated by reference, see § 571.5).

Plan view reference line means -

(a) For vehicles with bench-type seats, a line parallel to the vehicle longitudinal centerline outboard of the steering wheel centerline 0.15 times the difference between one-half of the shoulder room dimension and the steering wheel centerline-to-car-centerline dimension as shown in ~~Figure 2~~ Figure 6 of SAE Recommended Practice ~~J903a (1966)~~ J903 (xxx 2021)(incorporated by reference, see § 571.5); or

(b) For vehicles with individual-type seats, either -

(i) A line parallel to the vehicle longitudinal centerline which passes through the center of the driver's designated seating position; or

(ii) A line parallel to the vehicle longitudinal centerline located so that the geometric center of the 95 percent eye range contour is positioned on the longitudinal centerline of the driver's designated seating position.

Shoulder room dimension means the front shoulder room dimension "W3" as

defined in ~~section E, "Ground Vehicle Practice," of SAE Aerospace-Automotive Drawing Standards (1963)~~ Table 17 SAE J1100 " Motor Vehicle Dimension" (November 2009) (incorporated by reference, see § 571.5).

95 percent eye range contour means the 95th percentile tangential cutoff specified in SAE Recommended Practice J941 ~~(1965)~~ (March 2010 now WIP) (incorporated by reference, see § 571.5).

S4. *Requirements.*

S4.1 *Windshield wiping system.* Each vehicle shall have a power-driven windshield wiping system that meets the requirements of S4.1.1. S4.1.1 *Frequency.*

S4.1.1.1 Each windshield wiping system shall have at least two frequencies or speeds.

S4.1.1.2 One frequency or speed shall be at least 45 cycles per minute ~~regardless of engine load and engine speed.~~

S4.1.1.3 ~~Regardless of engine speed and engine load, the~~ The highest and one lower frequency or speed shall differ by at least 15 cycles per minute. Such lower frequency or speed shall be at least 20 cycles per minute ~~regardless of engine speed and engine load~~.

S4.1.1.4 Compliance with subparagraphs S4.1.1.2 and S4.1.1.3 may be demonstrated by testing under the conditions specified in sections 4.1.1 and 4.1.2 of SAE Recommended Practice ~~J903a (1966)~~ J903 (xxx2021)(incorporated by reference, see § 571.5).

S4.1.2 *Wiped area.* When tested wet in accordance with SAE Recommended Practice ~~J903a (1966)~~ J903 (xxx2021) (incorporated by reference, see § 571.5), each passenger car windshield wiping system shall wipe the percentage of Areas A, B, and C of the windshield (established in accordance with S4.1.2.1) that (1) is specified in column 2 of the applicable table following subparagraph S4.1.2.1 and (2) is within the area bounded by a perimeter line on the glazing surface 25 millimeters from the edge of the ~~daylight opening~~ design glass outline .

S4.1.2.1 Areas A, B, and C shall be established as shown in Figures 1 and 2 of SAE Recommended Practice ~~J903a (1966)~~ J903 (xxx2021) (incorporated by reference, see § 571.5) using the angles specified in Columns 3 through 6 of Table I, II, III, or IV, as applicable.

TABLE I - ~~PASSENGER CARS~~ APPLICABLE VEHICLES OF LESS THAN 1520 MILLIMETERS IN OVERALL WIDTH

Column 1 - Area	Column 2 - Minimum percent to be wiped	Angles in degrees			
		Column 3 - Left	Column 4 - Right	Column 5 - Up	Column 6 - Down
A	80	16	49	7	5
B	~~94~~92	13	46	4	3
C	99	7	15	3	1

TABLE II - ~~PASSENGER CARS~~ APPLICABLE VEHICLES OF 1520 OR MORE BUT LESS THAN 1630 MILLIMETERS IN OVERALL WIDTH

Column 1 - Area	Column 2 - Minimum percent to be wiped	Angles in degrees			
		Column 3 - Left	Column 4 - Right	Column 5 - Up	Column 6 - Down
A	80	17	51	8	5
B	~~94~~ 92	13	49	4	3
C	99	7	15	3	1

TABLE III - ~~PASSENGER CARS~~ APPLICABLE VEHICLES OF 1630 OR MORE BUT LESS THAN 1730 MILLIMETERS IN OVERALL WIDTH

Column 1 - Area	Column 2 - Minimum percent to be wiped	Angles in degrees			
		Column 3 - Left	Column 4 - Right	Column 5 - Up	Column 6 - Down
A	80	17	53	9	5
B	~~94~~ 92	14	51	5	3
C	99	8	15	4	1

TABLE IV - ~~PASSENGER CARS~~ APPLICABLE VEHICLES OF 1730 OR MORE MILLIMETERS IN OVERALL WIDTH

Column 1 - Area	Column 2 - Minimum percent to be wiped	Angles in degrees			
		Column 3 - Left	Column 4 - Right	Column 5 - Up	Column 6 - Down
A	80	18	56	10	5
B	~~94~~ 92	14	53	5	3
C	99	10	15	5	1

S4.2 *Windshield washing system.*

S4.2.1 Each passenger car shall have a windshield washing system that meets the requirements of SAE Recommended Practice J942 ~~(1965)~~(xxx2019) (incorporated by reference, see § 571.5)~~, except that the reference to "the effective wipe pattern defined in SAE J903, paragraph 3.1.2 3.9" in paragraph 3.1 of SAE Recommended Practice J942 (1965) (xxx 2019)shall be deleted and "the areas established in accordance with subparagraph S4.1.2.1 of Motor Vehicle Safety Standard No. 104" shall be inserted in lieu thereof~~.

~~S4.2.2 Each multipurpose passenger vehicle, truck, and bus shall have a windshield washing system that meets the requirements of SAE Recommended Practice J942 (1965) (incorporated by reference, see § 571.5), except that the reference to "the effective wipe pattern defined in SAE J903, paragraph 3.1.2" in paragraph 3.1 of SAE Recommended Practice J942 (1965) shall be deleted and "the pattern designed by the manufacturer for the windshield wiping system on the exterior surface of the windshield glazing" shall be inserted in lieu thereof.~~

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755, Jan. 6, 2012]