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Docket Management Facility
U.S. Department of Transportation
1200 New Jersey Avenue SE
West Building Ground Floor, Room W12-140
Washington, D.C. 20590-0001

RE: Docket No. NHTSA-2020-0109

The Truck and Engine Manufacturers Association ("EMA") hereby submits comments on the Advance Notice of Proposed Rulemaking ("ANPRM") titled *Federal Motor Vehicle Safety Standards: Test Procedures* that the National Highway Traffic Safety Administration ("NHTSA" or the "Agency") recently published in the Federal Register. <u>See</u>, 85 Fed. Reg. 79,456 (December 10, 2020).

EMA represents the world's leading manufacturers of heavy-duty engines and commercial motor vehicles with a gross vehicle weight rating ("GVWR") greater than 10,000 pounds. EMA member companies manufacture highly customized medium- and heavy-duty vehicles to perform a wide variety of commercial functions including interstate trucking, regional freight shipping, intracity pickup and delivery, local parcel delivery, refuse hauling, and construction. EMA member companies utilize the test procedures specified in NHTSA's Federal Motor Vehicle Safety Standards ("FMVSSs") to certify the vehicles they produce. Accordingly, EMA and its member companies have a direct stake in the ANPRM and any future changes to the FMVSS test procedures.

We fully support NHTSA's goal of identifying FMVSS test procedures that "may specify testing that is no longer necessary, or may not be clear about how to test vehicles with newer technology, or may even have the effect of prohibiting the introduction of such vehicles." <u>See</u>, *id.* at 79,548. Vehicle technologies are rapidly advancing and we appreciate the Agency's efforts to improve the standards and minimize burdens. We are providing these comments in that practical and constructive spirit.

The ANPRM references the Office of the Secretary of Transportation's ("OST's") 2017 *Notification of Regulatory Review* that invited input on rules that "are good candidates for repeal, replacement, suspension, or modification." See, 82 Fed. Reg. 45,750 (October 2, 2017). In response to the OST notification, we submitted comments in which we included FMVSS No. 121, *Air brake systems*, as one of the standards where improvements could be beneficial. See, Docket ID No. DOT-OST-2017-0069-2786. In the subject ANPRM, the Agency specifically requested more information from EMA "about the modifications that would update the standard to keep pace with advances in heavy-duty air brake components and systems, and why, specifically, they are needed." See, 85 Fed. Reg. 79,458 (December 10, 2020). We greatly appreciate the Agency's interest in more details about our concerns and provide the following requests for modifications to FMVSS No. 121, plus a recommendation regarding FMVSS No. 108.

FMVSS No. 121, Air Brake Systems – Electronic Control

FMVSS No. 121 is an extensive and complex standard that has been revised many times over the past decades; however, one foundational and important aspect of the standard remains unchanged. The air brake standard requires two parallel air systems, each receiving an air control signal from the driver's brake pedal to actuate the air pressure that applies the brakes at each wheel. The two parallel air systems are isolated from each other so that a failure or leakage in one system will not affect the other. If one air systems fails, the other can still receive the signal from the brake pedal and apply the brakes to slow or stop the vehicle. FMVSS No. 121 even includes an emergency brake system test procedure and performance requirements that must be met after a failure of any part designed to contain compressed air. See, 49 C.F.R. § 571.121, S5.7.1. The redundancy established by the two air systems is needed to meet those "failed system" test procedures and performance requirements; it is a foundational aspect of the standard and a crucial reason that heavy-duty truck air brake systems exhibit a high level of safety performance.

Air pressure has long proven to be an effective medium for generating the force needed to apply heavy truck brakes, but air pressure is a relatively inefficient and limited medium for transmitting control signals from the driver's brake pedal. In the alternative, braking system and truck engineers have identified many advantages to using electronic controls to transmit the signal from the brake pedal to the air reservoirs in the chassis. Electronic signals travel faster than air, and therefore can apply the brakes quicker. Electronic controls provide more consistent brake application timing, better tire adhesion, and brake fade compensation. Additionally, electronic controls unlock the potential to deploy advanced braking control technologies such as electronic brake force distribution, load proportioning, and coupling force control. Electronic controls also reduce the amount of required maintenance, allow monitoring of brake lining wear, and enable improved monitoring of the response of the braking system. Looking toward increased deployment of advanced driver assistance systems ("ADAS"), electronic brake controls allow better integration of the air braking system to those technologies and pave the way to future braking controls for highly automated trucks. Electronic controls also provide an improved platform for battery-electric zero-emission vehicles by allowing sophisticated blending of retarder braking and traditional friction brakes to maximize energy recovery strategies.

Several minor modifications are needed to FMVSS No. 121 to remove the barriers to deployment of electronic controls of the air brake system, or electronically-control braking system ("ECBS"), and unlock the above beneficial braking system features. Further, with strategic changes to the standard to permit ECBS, the benefits of the redundancy that is a hallmark of FMVSS No. 121 could remain just as effective as it is today. Following are four targeted modifications to FMVSS No. 121 that would allow the use of ECBS while maintaining that important redundancy:

1. **Modify the definition of "Air brake system" to include "electronic-over-air brake subsystem" in S4, *Definitions,* as follows:**

Air brake system means a system that uses air as a medium for transmitting pressure or force from the driver control to the service brake, including an air-over-hydraulic brake subsystem, or an electronic-over-air brake subsystem, but does not include a system that uses compressed air or vacuum only to assist the driver in applying muscular force to hydraulic or mechanical components.

2. **Add the following definition for "electronic-over-air brake subsystem" in S4:**

Electronic-over-air brake subsystem means a subsystem of the air brake system that uses electronic signals from the driver control to actuate the air service brakes.

3. **Add ECBS malfunction warning signal requirements in S5.1.5, *Warning signal*:**

S5.1.5 Warning ~~*signal*~~signals.

S5.1.5.1 *Low brake air pressure.* A signal, other than a pressure gauge, that gives a continuous warning to a person in the normal driving position when the ignition is in the "on" ("run") position and the air pressure in the service reservoir system is below 60 psi. The signal shall be either visible within the driver's forward field of view, or both audible and visible. The low brake air pressure telltale shall be per Standard No. 101 (§ 571.101).

Low Brake Air Pressure Telltale (for vehicles subject to FMVSS 121)	—	Brake Air

S5.1.5.2 *Brake system malfunction.* A signal that gives a continuous warning to a person in the normal driving position when the ignition is in the "on" ("run") position whenever there is a malfunction that affects the generation or transmission of response or control signals in the electronic-over-air brake subsystem. The warning signal shall be either visible within the driver's forward field of view, or both audible and visible. The brake system malfunction telltale shall be per Standard No. 101 (§ 571.101).

Brake system malfunction	--------	Brake	Telltale	--------	Red [4]

4. **Modify S5.5.1, *Antilock system malfunction*, to clarify the timing requirements to maintain the existing stringency during an ABS malfunction:**

S5.5.1 *Antilock system malfunction.* On a truck tractor manufactured on or after March 1, 1997, that is equipped with an antilock brake system and a single unit vehicle manufactured on or after March 1, 1998, that is equipped with an antilock brake system, a malfunction that affects the generation or transmission of response or control signals of any part of the antilock system shall not increase the actuation and release times of the service brakes <u>beyond the requirements in S5.3.3 and S5.3.4</u>.

The above four strategic and targeted FMVSS No. 121 modifications would not only allow manufacturers to deploy ECBS but they also would enhance standard by providing an additional warning signal to immediately alert the driver of any failure of the ECBS. (Currently, the driver will not be made aware of a failure of the pneumatic control system until enough air leaks from the systems to cause a low brake air pressure warning.) Crucially, the FMVSS No. 121 redundancy would remain with a traditional pneumatic control as back-up to the ECBS. The failed system test procedures and performance requirements would remain in the standard and continue requiring the redundancy that makes heavy-duty air brakes systems so safe. In sum, modifying FMVSS No. 121 can be done in a manner that provides significant safety benefits to heavy-duty truck braking systems without imposing any safety risks.

FMVSS No. 121, Air Brake Systems – Typographical Errors

We recommend correcting two typographical errors should be corrected in FMVSS No. 121, S5.7.1, *Emergency brake system performance*, to refence the correct stopping distance requirements for the failed system test. See the corrections shown in the mark-up below:

S5.7.1 *Emergency brake system performance.* When stopped six times for each combination of weight and speed specified in S5.3.1.1, except for a loaded truck tractor with an unbraked control trailer, on a road surface having a PFC of 0.9, with a single failure in the service brake system of a part designed to contain compressed air or brake fluid (except failure of a common valve, manifold, brake fluid housing, or brake chamber housing), the vehicle shall stop at least once in not more than the distance specified in Column ~~5~~<u>7</u> of Table II, measured from the point at which movement of the service brake control begins, except that a truck-tractor tested at its unloaded vehicle weight plus up to 1500 pounds shall stop at least once in not more than the distance specified in Column ~~6~~<u>8</u> of Table II. The stop shall be made without any part of the vehicle leaving the roadway, and with unlimited wheel lockup permitted at any speed.

FMVSS No. 121, Air Brake Systems – Brake Release Timing

FMVSS No. 121 includes an outdated specification for the maximum amount of time for the air pressure in the brake chambers to fall from 95 psi to 5 psi after the driver releases the brake pedal. <u>See</u>, 49 C.F.R. § 571.121, S5.3.4, *Brake release time*. The brake release timing requirement was established decades ago to allow the driver to modulate the brakes on and off as a method of maintaining tire adhesion to the slippery road surfaces. However, since the brake release timing standard was included, FMVSS No. 121 has been upgraded to mandate antilock braking systems ("ABS") that are capable of modulating the brakes at speeds that are orders of magnitude faster than the static brake release timing requirement. To properly drive a heavy truck with ABS, drivers are instructed to apply steady brake pressure on slippery roads and let the ABS modulate the brakes to maintain tire adhesion and directional stability. ABS has proven to be extremely effective in allowing the driver of a heavy truck to maintain lateral stability during braking on slippery road surfaces. While the brake release timing requirement has been rendered unnecessary by ABS, it still complicates the deployment of ABS and other braking systems technologies. ABS, automatic traction control ("ATC"), electronic stability control ("ESC"), and other braking system technologies add complex air plumbing and valving to control the air brake system. Those additional air lines and valves slow air movement in the system and make it challenging to meet the static brake release timing requirement. To eliminate that unnecessary obstacle to the deployment of advanced braking system technologies, we request that NHTSA remove the requirement.

FMVSS No. 121, Air Brake Systems – Air Dryers

FMVSS No. 121 includes another outdated requirement for a supply air reservoir or automatic condensate drain valves. See, *id.* at S5.1.2. The purpose of those devices is to remove water vapor from the air in the air brake system. However, in the decades since NHTSA established the supply reservoir or automatic drain valve requirement, all manufacturers have deployed air dryers as a superior technology for removing water vapor from the air. An air dryer is a device that uses a desiccant to collect contaminants, including moisture, oil, and other debris, and automatically purges those contaminants. Accordingly, we request that NHTSA update and improve FMVSS No. 121 by permitting manufacturers to install an air dryer instead of a supply reservoir or automatic drain valves.

FMVSS No. 121, Air Brake Systems – Test Wind Velocity

The FMVSS No. 121 test procedure permits testing only when the "wind velocity is zero." See, *id.* at S6.1.6. Zero wind is not practicable at any outdoor test facility, which is where heavy trucks must be tested. Instead, we recommend using the maximum wind specifications NHTSA's *Laboratory Test Procedure for FMVSS No. 121 – Air Brake Systems*. See, TP-121V-05 (March 12, 2004). The Test Procedure specifies that during testing the "[w]ind velocity shall not exceed 15 mph" and that "[s]tops must not be made with a tail wind component in excess of 5 mph." See, *id.* at p.29. A maximum wind speed of 15 mph, and a maximum tail wind during stops of 5 mph, are practicable for FMVSS No. 121 testing without impacting the test results, as recognized by NHTSA in the Laboratory Test Procedure. We request that NHTSA update FMVSS No. 121 accordingly.

FMVSS No. 108, Lamps, Reflective Devices, and Associated Equipment

The test procedures in FMVSS No. 108 include specific test voltages for use in measuring the photometry of a lamp, such as 12.8 V ±20 mV, D.C. See, *e.g.*, 49 C.F.R. § 571.108, S14.2.5.4. However, that required test voltage assumes that the vehicle has a 12 V electrical system and that the lamps are designed to operate on 12 V electrical power.

Historically and currently, there is motivation to implement in the U.S. vehicle electrical systems rated at voltages other than 12 V. In the present, there are discussions around 48 V vehicle systems driven by the proliferation of electric vehicles, and in the past there were discussions around 42 V vehicle systems for light-duty hybrid electric vehicles. Globally, it is common for heavy-duty vehicles to use a 24 V electrical system. There are cost and weight benefits seen in adopting higher voltage systems, and it also gives the opportunity to standardize electrical architectures on a global scale, enabling the application and proliferation of globally developed ADAS and automated driving system ("ADS") features. Also, with the proliferation of Light Emitting Diode ("LED") technology for automotive exterior lighting, photometric performance of headlamps using LED's are much less sensitive to variations in system voltage. LED's used in modern headlamp designs will provide the same light intensity over a fairly large range of vehicle system input voltages (+/- 25%).

In FMVSS No. 108 there are prescriptions for a test voltage of 12.8 V in the sections for headlamp and DRL photometry tests (S14.2.5 and S14.2.4), the headlamp aiming requirements (S10.18.9.4.2), and the associated headlamp physical tests (corrosion (S14.6.4), sealing (S14.6.9), wattage (S14.6.16), and power and flux for replaceable bulbs (S14.7.3)). There are also requirements to use a test voltage of either 6.4 V or 12.8 V found in the sections for testing associated lighting equipment in S14.9.x (turn signal operating unit, hazard operating unit, and the flasher module).

The test procedures in FMVSS No. 108 unnecessarily impede manufacturers from using higher voltage vehicle electrical systems and/or LED lamps. To eliminate the barrier to those technologies, we recommend modifying the test procedures in the standard to specify using "design voltage," as defined in S4, *Definitions*, to test the photometry of all lamps.

Conclusion

EMA looks forward to working with the Agency to address the issues noted above and any additional FMVSS test procedure issues affecting medium- and heavy-duty trucks. If there are any questions, or we could provide any additional information, please do not hesitate to contact Timothy Blubaugh at (312) 929-1972, or tblubaugh@emamail.org.

Respectfully submitted.

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