

In contrast, WhiteGMC/Volvo, Haldex, Eaton, and Advocates believed that the proposal would be detrimental to safety, primarily because the proposed amendments would make the reservoir requirements less stringent. WhiteGMC/Volvo stated that the proposal promotes less reservoir volume and extended application times. Advocates had "misgivings about the regulatory approach" in the NPRM which it believed would significantly reduce the total operating reserve volume of the brake reservoirs, thereby allowing manufacturers to install undersized brake reservoirs. Haldex stated that the proposal was ill advised and premature because it would result in a decrease in the reserve air volume. Instead, it favored issuance of a "performance based standard." Eaton was concerned that the proposal was a "quick fix" that would degrade heavy truck brake system performance.

After reviewing testing conducted at VRTC, the comments, and other available information, NHTSA has determined that the amendments to Standard No. 121's reservoir requirements will ensure the safe braking of air-braked vehicles, since it will not adversely affect their reservoir capacity. Specifically, testing conducted at VRTC indicate that today's amendments to Standard No. 121 will not cause a significant reduction in a brake system's maintaining adequate pressure even under adverse conditions, affect its application and release times, or contribute to a vehicle's propensity to jackknife.

With respect to a brake system's air reserves, VRTC and SAE testing indicate that long stroke chambers perform safely, even if the volume of the reservoirs are not increased to reflect the increased volume of the long stroke chambers. In general, long stroke chambers use no more air than standard length brake chambers, if they are properly adjusted. This testing information has been placed in the public docket under "Reservoir Pressure Drop With ABS Cycling" and "SAE J1911 Tractor and Trailer Tests." Similarly, long stroke chambers in SAE J1911 tests show the same air consumption as a conventional brake chamber, when properly adjusted.

The only time a long stroke chamber will consume more air is when the automatic adjuster is not functioning correctly and the stroke is at the outer limit of adjustment. To protect against such situations, the agency has decided to specify an upper limit for the maximum stroke of brake chambers for which a vehicle manufacturer can use the "rated volume" in determining the

minimum reservoir volumes. The agency has specified that the upper limit be 20 percent above the nominal stroke for a normal stroke brake chamber. For instance, Type 9 brakes will be allowed to have a stroke length of between 1.75 and 2.10 inches. The agency has rejected the upper limits recommended by Midland-Grau which in some cases would have increased the stroke length up to 40 percent. The agency believes that using "rated volumes" for such long stroke chambers might undermine the reservoir requirements.

With respect to brake application times, NHTSA has determined that long stroke brake chambers typically do not significantly affect brake apply and release times. The effect of brake adjustment level on timing is discussed in "NHTSA Heavy-Duty Vehicle Brake Research Program Report No. 5: Pneumatic Timing." DOT HS 806 897, December 1985. The one exception is in the highly unusual situation in which all the automatic brake adjusters on a vehicle fail and at the same time all of the units operate at the outer limit of adjustment or beyond. Even under this highly unlikely condition, the apply time would only increase by approximately 0.040 second and the release time by 0.024 second. Moreover, standard stroke chambers would be ineffectual in this situation. This equates to about three additional feet of stopping distance on the apply time and two additional feet on the release time.<sup>2</sup> Any such increases can be minimized, since vehicle manufacturers can change the apply and release times by modifying the valving to adjust or remove air flow restrictions. Similarly, the vehicle manufacturers could remove air flow restrictions to the glad hand and pass the signal faster to the trailer.

With respect to jackknives, NHTSA disagrees with Eaton's claim that equipping vehicles with long stroke chambers would increase the likelihood of jackknives. Jackknives are caused by wheel lockup due to hard brake applications on wet roads or when vehicles are empty or lightly loaded. The presence or absence of long stroke chambers will not affect the underlying foundation brakes. Specifically, VRTC studies<sup>3</sup> show that stroke lengths do not affect brake timing. The agency further notes that long stroke chambers improve brake adjustment and the resulting brake balance between tractors and trailers, thereby improving a

combination vehicle's directional stability and control and decreasing the likelihood of jackknifing.

### C. Changes to Proposed Regulatory Text

Several commenters recommended that the proposed wording of Table V and S5.1.2.1 and S5.2.1.2 be modified to provide greater flexibility to manufacturers. For instance, ATA requested that the words "on CAM Brakes" be deleted from the title in Table V so that it reads—"Brake Chamber Rated Volumes." ATA also requested that the words "brake chamber" be changed to "brake actuator" and that "actuator" be inserted into Table V to clarify that the "type" is a brake actuator classification and not a brake classification. Similarly, ITI recommended that S5.1.2.1 and S5.2.1.2 be revised to permit brake chambers that were not of the sizes specifically listed in Table V. Allied recommended that the wording "maximum travel of pistons or push rod" be replaced with "full stroke of push rods." It also recommended "defining chamber type as being the nominal effective area of a piston or diaphragm."

NHTSA has modified certain provisions in the regulatory text pursuant to the comments. For instance, it has modified the title to Table V to state "Brake Chamber Rated Volumes" instead of "Brake Chamber Rated Volumes on Cam Brakes." The agency agrees with the commenters that including the reference to cam brakes was unnecessarily narrow and might imply exclusion for use of other brake types such as air disc, wedge, and air-over-hydraulic. NHTSA has also incorporated Allied Signal's request for the regulation to indicate that chamber type is the nominal effective area of a piston or diaphragm, by adding this information to the top of column one in Table V.

NHTSA decided not to modify other provisions in the regulatory text, notwithstanding recommendations by commenters to the NPRM. For instance, the agency decided not to adopt ATA's request to change the phrase "brake chamber" to "brake actuator."

There are numerous references to brake chamber throughout Standard No. 121, which are well understood by the technical personnel who rely on the requirements. "Brake actuator" may explain what an air-brake chamber does (i.e., that it actuates the brakes when it fills with air); however, it adds nothing to what is already understood. Similarly, the agency decided not to adopt Allied Signal's request to eliminate the term "piston." While the

<sup>2</sup> NHTSA's Heavy-Duty Vehicle Research Program Report No. 5: Pneumatic Timing. DOT HS 806 897, December 1985.

<sup>3</sup> Id.