

may meet the requirements in FMCSR 393.45.

While FMVSS No. 106's air brake hose performance requirements and test procedures are currently presented in terms of nominal inside diameter, the agency notes that plastic air brake tubing is sized according to nominal outside diameter. In an August 7, 1974, amendment to FMVSS No. 106 (39 FR 28436), NHTSA responded to a petition from Samuel Moore Company in which the petitioner contended that it was appropriate to base Standard No. 106's tensile strength requirements on the nominal inside diameter of the tubing rather than on the tubing's nominal outside diameter. The petitioner argued that because $\frac{3}{8}$ -inch nominal OD plastic tubing has an inside diameter of $\frac{1}{4}$ -inch and provides the same air flow capability as a $\frac{1}{4}$ -inch nominal ID rubber hose, they should be subject to the same tensile strength requirements. In response to the petition, NHTSA decided to base the tensile strength requirements on the nominal inside diameter of the hose or tubing. Because plastic air brake tubing is labeled according to its nominal outside diameter, however, NHTSA now proposes to specify tensile strength requirements in the same manner to minimize confusion.

Unlike FMVSS No. 106, SAE J1131 does not contain a stand-alone tensile strength test for air brake tubing assemblies. Instead, SAE J1131 specifies tensile strength testing after an air brake tubing assembly has been assembled and pre-conditioned in some manner. The SAE tensile strength performance requirements for pre-conditioned tubing assemblies are not as rigorous as NHTSA's stand-alone requirements. Although the agency proposes to incorporate SAE J1131's tensile strength requirements, NHTSA also proposes to retain the stand-alone tensile strength requirements already present in FMVSS No. 106, with the modifications discussed below.

Standard No. 106's tensile strength requirements provide an alternative set of requirements for coiled nylon tubing. Coiled nylon tubing may either meet the tensile strength requirements in FMVSS No. 106 or, alternatively, may meet the requirements in section 393.45 of the FMCSRs. FMCSR § 393.45, in turn, references the tensile strength requirements of SAE J844. The agency notes, however, that SAE J844 does not contain tensile strength requirements for end fitting retention. The end fitting retention requirements are contained in SAE J1131, which is not referenced in FMCSR § 393.45.

Coiled nylon tubing assemblies, by design, provide that tensile loads on these assemblies are spread out over the long length of the hose in its coiled form, and thus large amounts of relative motion, such as between a tractor and a semi-trailer, are not expected to result in significant tensile load on the end fittings that would pull the tubing out of the fitting. Nevertheless, NHTSA tentatively concludes that the potential exists for the supply and control air lines connecting tractors and semi-trailers to get tangled among themselves, among various components (springs and poles) that are used to support the lines above the truck frame, or with the electrical cord. The agency also notes that these air lines are completely exposed to the elements, are frequently connected and disconnected, and may be subject to various amounts of stretching depending on the physical dimensions of the trailers that are towed.

Despite these potential hazards in the operating environment of coiled nylon tubing, however, FMVSS No. 106, as presently constituted, provides no tensile strength requirements for coiled nylon tubing assemblies if the optional compliance with SAE J844 as referenced in § 393.45 is exercised. In contrast, small, $\frac{1}{8}$ -inch air brake tubing is essentially prohibited from use in air brake systems because of its inability to meet Standard No. 106's 50-pound tensile strength requirement, even though the application of this tubing would typically be inside the truck cab and routed to protect it from damage. As discussed below, NHTSA proposes to correct this disparity in treatment by requiring coiled nylon tubing to meet SAE J1131's end fitting retention requirements and by lowering the tensile strength requirements for tubing with relatively small nominal outside diameters. The agency proposes to lower the tensile strength requirement for $\frac{1}{8}$ -inch nominal OD tubing from 50 pounds to 35 pounds and, for $\frac{3}{32}$ -inch OD tubing, from 50 pounds to 40 pounds.

The agency proposes to retain the existing FMVSS No. 106 tensile strength requirements for air brake tubing assemblies used between a frame and an axle, or between a towed and a towing vehicle, of 250 pounds for a $\frac{3}{8}$ -inch or less, or 10 mm or less, in nominal outside diameter, and 325 pounds for a tubing assembly larger than $\frac{3}{8}$ -inch or 10 mm in nominal outside diameter. With respect to plastic air brake tubing assemblies used for any other purpose, the agency proposes to require a tensile strength of: 35 pounds for tubing with a nominal outside diameter of $\frac{1}{8}$ inch

or less (3 mm or less); 40 pounds for tubing with a nominal outside diameter of $\frac{5}{32}$ inch (4 mm); 50 pounds for tubing with a nominal outside diameter between $\frac{3}{16}$ -inch and $\frac{3}{8}$ -inch (between 5 mm and 10 mm); 150 pounds for tubing with a nominal outside diameter between $\frac{1}{2}$ -inch and $\frac{5}{8}$ -inch (between 11 mm and 16 mm); and 325 pounds for tubing with a nominal outside diameter larger than $\frac{5}{8}$ -inch (16 mm).

2. Hot Tensile Strength

SAE J1131 specifies that a 6-inch long tubing assembly be placed in a tensile testing machine, with the lower 4 inches of the assembly submerged in boiling water for 5 minutes. The assembly is then pulled at a rate of 1 inch per minute. The required performance is either 50 percent elongation of the hose without end fitting separation or the assembly must sustain a specified tensile load. Standard No. 106 does not have a corresponding test condition. Compared to the tensile strength requirements in FMVSS No. 106, the end fitting separation strength requirements in SAE J1131 are lower, but Standard No. 106's requirements are for non-conditioned tubing assemblies. NHTSA proposes that the hot tensile strength requirement from SAE J1131 be incorporated into FMVSS No. 106. Considering that SAE J1131 does not include tensile loads for metric sized plastic brake tubing, however, the agency proposes to specify tensile load values for metric sized plastic brake tubing.

3. Conditioned Pull Test

SAE J1131 specifies that a tubing assembly undergo four temperature cycles of a minus 40 degree F cold soak for 30 minutes, normalizing at 75 degrees F, immersion in boiling water for 15 minutes and normalizing at 75 degrees F. After four complete cycles of temperature conditioning, the tubing assembly is subjected to a tensile test. The required performance is the same as for the hot tensile strength test above. This test evaluates the tubing's resistance to pulling out of its end fittings when subjected to thermal cycling. Equivalent performance requirements/test procedures are not included in FMVSS No. 106. NHTSA proposes that these performance requirements/test procedures be incorporated into Standard No. 106.

4. Vibration Leak Test

SAE J1131 specifies that an 18-inch long hose assembly be subjected to one million cycles on a vibration machine with one end of the hose fixed and the other end stroked 0.5 inches