

for smaller diameter, non-reinforced tubing made from one layer of material, or "B" for larger diameter tubing made from two layers of material with a reinforcement braid located at the layer interface. Tubing is sized by the nominal OD of the tubing either in fractions of an inch or in millimeters. These designations are appropriate for plastic tubing but FMVSS No. 106 does not currently contain any references to Type A and B tubing or any dimensional requirements for plastic tubing.

It should be noted that FMCSR § 393.45(b)(ii) specifies that, for plastic tubing used on commercial motor vehicles, the reference to SAE J844 only includes Type B tubing. NHTSA proposes to update FMVSS No. 106 to include requirements for both Types A and B plastic tubing.

## 2. Dimensions and Tolerances

SAE J844 includes a table (Table 1) that prescribes, for each nominal size of tubing, the ID, OD, minimum wall thickness, and tolerances on the ID and OD. There are no corresponding dimensions in FMVSS No. 106. These dimensions are safety-critical because they ensure that the tubing is compatible with the fittings designed for that tubing. Incompatibility between tubing and end fittings can, among other things, cause the inside diameter of the tubing to collapse. NHTSA agrees with the petitioners that, if there are no requirements for these dimensions, there is the possibility that tubing of improper dimensions could pull out of the end fittings or otherwise prematurely fail at the connections, leak because of improper sealing due to dimensional incompatibility with fittings, or loosen due to thermal expansion and contraction. Accordingly, NHTSA proposes to incorporate into Standard No. 106 the dimension and tolerance requirements contained in SAE J844.

## 3. One Hundred Percent Leak Test

SAE J844 requires tubing manufacturers to subject all air brake tubing to a 200-psi leak test. The specific testing methods, including test media, rate of application, and required performance measures, are not specified in SAE J844 and are, therefore, determined by the tubing manufacturer.

FMVSS No. 106 does not address the quality control methods that hose manufacturers use to ensure that all hoses installed on motor vehicles will meet the standard. Rather, the manufacturers of such components are required to certify compliance, and each brake hose or assembly is required to

meet the standard. NHTSA tentatively concludes that plastic air brake tubing manufacturers will continue to perform quality control tests on their products, but that such requirements should not be included in FMVSS No. 106.

## 4. Burst Test

SAE J844 specifies that tubing be stabilized at 75 degrees F for a period of 30 minutes to 3 hours. Pressure (of an unidentified medium, assumed to be air) in the tube is increased at a constant rate to reach a specified minimum burst pressure (specified in Table 2) within a time period of 3 to 15 seconds. The tubing must sustain the specified pressure without bursting. FMVSS No. 106 specifies using water as the test media, with a pressure increase rate of approximately 1,000 psi per minute, to a pressure of 800 psi. The specified pressures in Table 2 of SAE J844 range from 1000 to 1200 psi for Type A tubing and 800 psi to 1400 psi for Type B tubing (each size of tubing has one specific burst pressure). Therefore, the pressure requirements in SAE J844 are equal to or higher than those in FMVSS No. 106. While the performance differences of the different test media have not been measured, it would appear that using air would be more appropriate for air brake tubing than using water. NHTSA welcomes comments on the use of air versus water as the test medium.

In NHTSA's judgment, the greater pressure requirements in SAE J844 are more rigorous than existing requirements in FMVSS No. 106. NHTSA proposes changing the burst strength requirements in FMVSS No. 106 to the higher values in SAE J844, and specifying air as the test medium rather than water. NHTSA proposes that the pressure in the tubing be increased in a period of 5 seconds because using the range of 3 to 15 seconds in SAE J844 would specify testing at both 3 and 15 seconds and therefore would be too broad of a specification for use in FMVSS No. 106. NHTSA welcomes comments on the use of air versus water as the test medium.

## 5. Moisture Absorption

SAE J844 specifies that a tubing specimen be conditioned for 24 hours at 230 degrees F, immediately weighed, and then subjected to 100 percent relative humidity for 100 hours at 75 degrees F. Within five minutes of removal from the humidity chamber, surface moisture is wiped from all surfaces of the tubing and the tubing is weighed. The moisture absorption shall not exceed 2 percent by weight. FMVSS No. 106 does not have a corresponding

test. NHTSA proposes incorporating the moisture absorption specification from SAE J844 into FMVSS No. 106.

## 6. Ultraviolet Resistance

SAE J844 specifies that the tubing be placed in a Q-Panel QUV test apparatus equipped with Philips Type UVS-340 bulbs. If the test apparatus is equipped with a "Solar Eye," the bulbs need not be rotated and the irradiance should be set at 0.85; however, all bulbs should be discarded after 4800 hours maximum or if they fall below the 0.85 irradiance level, whichever occurs first. If the test apparatus is not equipped with a "Solar Eye," the bulbs must be rotated every 400 hours maximum, per the apparatus manufacturer and ASTM G 53. Bulbs used in such an apparatus must be discarded after 1600 hours of use.

The samples are placed in the sample racks of the test apparatus and are exposed for 300 hours at a temperature of 113 degrees F, with the surface of the specimen mounting plate located no more than 2 inches from the bulbs. The samples are rotated according to ASTM D 4329 except the rotation is each 96 hours rather than weekly. No humidity other than ambient is introduced. Immediately after the samples are removed from the ultraviolet light test apparatus, they are subjected to an impact test using a device depicted in Figure 1 of SAE J844. The tubing samples are then cooled to 75 degrees F and subjected to a burst test, with a minimum burst pressure that is at least 80 percent of the value assigned to the tubing based on the tubing's outside diameter as indicated in Figure 2 of SAE J844.

NHTSA notes that in November 1973 (38 FR 31302), NHTSA deleted the ultraviolet light resistance tests for air brake hoses in Standard No. 106, stating that sufficient data had not been generated to support a minimum performance requirement. However, NHTSA tentatively concludes that the plastic material used in nylon air brake tubing is significantly different from the materials used in rubber air brake hoses, and that plastic is susceptible to deterioration that can cause embrittlement due to exposure to ultraviolet light. NHTSA also notes that air brake tubing is installed on heavy vehicles in locations that are exposed to naturally-occurring ultraviolet light. Therefore, NHTSA proposes to incorporate SAE J844's ultraviolet resistance test into FMVSS No. 106, although the agency proposes to reference the apparatus specified in ASTM G154-00, *Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic*