

requirements from SAE J844 into FMVSS No. 106.

12. Boiling Water Stabilization and Burst Test

SAE J844 specifies that the tubing be immersed in boiling water for 2 hours. The tubing is then removed from the water and subjected to a burst test at room temperature. The standard specifies a minimum burst strength of 80 percent of the value assigned to the tubing based on the tubing's nominal outside diameter. NHTSA tentatively concludes that this test condition is redundant because a similar boiling water conditioning test, followed by impact and burst tests, is already specified by the third heat aging test, as described above. FMVSS No. 106 has no corresponding test procedure. Because NHTSA is already proposing to incorporate the heat aging test from SAE J844, the agency does not propose to also incorporate SAE J844's stand-alone boiling water stabilization and burst test.

13. Cold Temperature Impact

SAE J844's cold temperature impact test specifies the use of 10 separate samples of air brake tubing. Five samples are conditioned for 24 hours at 230 degrees F, and the other five are conditioned in boiling water for 2 hours. All samples and the impact test apparatus are then conditioned at minus 40 degrees F for 4 hours. Each sample is then subjected to the impact test per Figure 1, with no visible cracks permitted. Each sample is then warmed to 75 degrees F and, within 30 minutes of stabilization at this temperature, a burst test conducted. Each tubing sample must withstand 80 percent of the specified burst strength. If any one of the samples fails these tests, the entire test sequence is repeated using twenty samples. If any one of these twenty samples fails, then the entire manufacturing lot is to be rejected. This test evaluates the resistance of the tubing to cold temperature fracturing. FMVSS No. 106 does not have corresponding test procedures/performance requirements.

In an August 1970 notice of proposed amendment to FMVSS No. 106 (35 FR 13738), NHTSA's predecessor agency, the National Highway Safety Bureau, addressed the issue of a sampling approach in testing standards. That notice indicated that the SAE approach, which includes testing of several samples and then retesting additional samples if initial failures are found, is not an essential methodology to demonstrate non-compliance. Rather, the agency indicated that it favored

testing one brake hose sample to determine compliance. Manufacturers, on the other hand, should or may conduct testing on multiple samples as part of their quality control procedures to determine whether continued failures exist such as to demand rejection of an entire manufacturing lot. NHTSA tentatively concludes that it is still preferable to subject only one sample to a particular set of testing procedures for compliance purposes. Accordingly, the agency proposes that only one plastic brake tubing sample be subjected to the cold impact test procedures contained in SAE J844. With this one modification, NHTSA proposes to incorporate the cold impact test procedures/performance requirements from SAE J844 into FMVSS No. 106.

14. Adhesion Test

SAE J844 specifies that Type B, reinforced tubing, be subjected to an adhesion test. A helical sample $\frac{1}{4}$ inch wide and with a length equal to five times the circumference of the tubing is cut from the tubing. With the tubing sample at a temperature of 75 degrees F, a knife blade is used to initiate separation at the braid interface. Further attempts to separate the sample must result in no separation over the entire length of the test sample other than at points at which the braid is present. SAE J844 does not include any specifications for Type A, non-reinforced tubing because this type of hose is only manufactured from one layer. Standard No. 106 presently requires that hose have a minimum adhesion strength of 8 pounds per linear inch of hose.

NHTSA tentatively concludes that the "no separation" performance requirement in SAE J844 would be unenforceable because during a destructive test the tubing will ultimately fail at some point during the test. NHTSA tentatively concludes that the existing Standard No. 106 minimum adhesion requirement of 8 pounds per linear inch is suitable for rubber air brake hose. Given the SAE J844 "no separation" specification for Type B plastic tubing, however, NHTSA proposes that a higher minimum adhesion requirement is appropriate for that type of tubing. NHTSA therefore proposes a minimum separation value of 25 pounds per linear inch for Type B plastic tubing, which the agency tentatively concludes is severe enough to ensure that an adequate bond exists between the tubing layers but not so high as to present enforcement concerns. Accordingly, NHTSA proposes that the adhesion test procedures/performance requirements

for Type B tubing in SAE J844 be incorporated into FMVSS No. 106, with a minimum separation strength of 25 pounds per linear inch. Rather than specifying a stand-alone adhesion test, however, NHTSA is proposing to incorporate SAE J844's heat aging adhesion test, which is described below. With respect to Type A tubing, because such tubing is typically manufactured from a single extrusion of nylon with no internal layers, the agency does not believe it is necessary to specify an adhesion test for that type of tubing.

NHTSA proposes to deviate from SAE J844's test procedure because it appears that it would be difficult to mount the test specimen in a tension testing machine if the specimen is cut from a $\frac{1}{4}$ -inch wide helical section of tubing. NHTSA proposes that a 1-inch length of tubing be cut lengthwise and two flaps of material be cut using a sharp knife so that the test sample can be clamped in the machine. The adhesion test for air brake hose that uses a rotating mandrel to support the inner layers of the hose was considered for tubing but does not appear to be practical for tubing since it would be difficult to separate (cut) the outer layer of the tubing from the inner layer with the inner layer of the tubing in an intact, round shape. NHTSA welcomes comments on the proposed adhesion test procedures/performance requirements.

15. Heat Aging and Adhesion Test

SAE J844 specifies that a Type B tubing sample be conditioned in the first heat aging test (bend tubing, heat conditioning, and re-bend tubing after cooling) and then subjected to the adhesion test, detailed above. Type A tubing is not subjected to this test. FMVSS No. 106 does not have a corresponding set of test procedures/performance requirements. NHTSA proposes to incorporate the heat aging adhesion test procedures from SAE J844, but that the minimum adhesion performance requirement for Type B tubing be raised from 8 pounds per linear inch to 25 pounds per linear inch.

16. Collapse Resistance

SAE J844 specifies that three test samples of specified length be prepared and the minor outside diameter (OD) be measured. The minor OD is the smallest outside diameter of the tubing measured at the center of the sample, typically located 90 degrees from the natural lay line of the tubing. The samples are installed on a specified bend test fixture and, following the natural bend of the tubing, each tube is bent 180 degrees to the minimum kink radius listed in the standard. The samples are conditioned