

the pressure, tensile strength, and whip resistance requirements in SAE J1401 and FMVSS No. 106. NHTSA does not propose any changes to the existing water absorption requirements of FMVSS No. 106 but, as noted above, NHTSA does propose to incorporate SAE J1401's fast-pull test and 370-pound strength requirement into Standard No. 106's tensile strength test procedure. Accordingly, after being conditioned in water for 70 hours, hydraulic brake hose assembly would be required to meet these heightened tensile strength requirements.

#### 7. Low Temperature Resistance Test

Both SAE J1401 and FMVSS No. 106 specify identical test procedures for bending brake hose around a test cylinder after conditioning at minus 40 degrees F. However, SAE J1401 does not include test cylinder dimensions for hoses with inside diameters other than  $\frac{1}{8}$  inch or  $\frac{3}{16}$  inch, while FMVSS No. 106 includes test cylinder dimensions applicable to all sizes of brake hose. NHTSA does not propose any changes in Standard No. 106's low temperature resistance requirements/procedures.

#### 8. Brake Fluid Compatibility, Constriction, and Burst Strength

FMVSS No. 106 specifies that the hose be conditioned with SAE RM-66-05 Compatibility Fluid at 200 degrees F for 70 hours, and then subjected to constriction and burst strength tests. SAE J1401 specifies that the hose be conditioned using SAE RM-66-03 Compatibility Fluid at 248 +9 -0 degrees F for 70 to 72 hours prior to the constriction and burst strength tests. Thus, when compared to the test procedures specified in Standard No. 106, the SAE J1401 test is run at a higher temperature and uses the older SAE compatibility fluid. Because the RM-66-05 fluid has superseded the RM-66-03 fluid, NHTSA does not propose any change in the type of fluid specified for conditioning the hose. NHTSA does propose, however, to increase the conditioning temperature in FMVSS No. 106 to 248 degrees F.

#### 9. Ozone Resistance

The test cylinder dimensional specifications in SAE J1401 and FMVSS No. 106 are the same, although the test procedures in FMVSS No. 106 account for hose that are not long enough to fit

all the way around the test cylinder, while SAE J1401 provides test procedures for hose that exceed the test cylinder circumference and also for hose that collapse when subject to bending. SAE J1401 requires a higher concentration of ozone of 100 parts per million (ppm) compared to FMVSS No. 106, which requires a concentration of 50 ppm.

Both SAE J1401 and FMVSS No. 106 specify a conditioning temperature of 104 degrees F. In addition, both SAE J1401 and FMVSS No. 106 specify that the hose be subjected to ozone for at least 70 hours after which no visible cracks in the hose may be apparent when examined under 7-power magnification. Unlike FMVSS No. 106, however, SAE J1401 includes an additional dynamic ozone test, in which a cut length of hose is mounted in an environmental chamber, exposed to ozone at a 100 ppm concentration, and flexed on a specified apparatus through 3 inches of stroke at 0.3 Hz for 48 hours. SAE J1401 specifies that no cracking of the hose is permissible after 48 hours.

NHTSA proposes to upgrade FMVSS No. 106's ozone resistance requirements to incorporate the 100-ppm ozone concentration in SAE J1401. The agency also proposes to incorporate the dynamic ozone test in SAE J1401 into Standard No. 106. NHTSA tentatively concludes that such an upgrade is appropriate given the well-documented increase in ground-layer ozone formation and concentration in U.S. cities that has occurred since FMVSS No. 106 was first proposed in 1967. Requiring hydraulic brake hose to sustain increased ozone concentrations should more accurately reflect the present-day operating environments of brake hose and may prevent premature failure of the hose due to ozone exposure.

#### 10. End Fitting Corrosion Resistance

Both SAE J1401 and FMVSS No. 106 specify exposing hydraulic brake hose end fittings to salt spray in a chamber for 24 hours. The salt spray chamber specified in FMVSS No. 106 is based on specifications outlined in ASTM B117-64, while the chamber specifications in SAE J1401 are based on ASTM B 117 Appendix B. NHTSA tentatively concludes these are different versions of the same ASTM Standard Practice B117, which has been revised over time.

Instead of referencing either ASTM B117-64 or ASTM B 117 Appendix B, both of which are outdated, NHTSA proposes to change the reference in FMVSS No. 106 to the most recent set of ASTM specifications for salt spray chambers, which are found in ASTM B117-97.

Another difference between the end fitting corrosion resistance specifications in SAE J1401 and FMVSS No. 106 pertains to the mounting angle of the hose. SAE J1401 specifies that the hose shall be mounted at an angle between 15 and 30 degrees from vertical while FMVSS No. 106 specifies an angle of 30 degrees. Most of the end fitting corrosion resistance performance requirements in SAE J1401 and FMVSS No. 106 are similar or identical, with SAE J1401 typically providing tolerances on all parameters. SAE J1401 excludes brass end fittings from testing because apparently SAE deems those end fittings to have adequate corrosion resistance. While the two sets of performance requirements are very similar, Standard No. 106's requirements are somewhat more rigorous and inclusive. Accordingly, with the exception of updating the reference to the most recent set of ASTM specifications for salt spray chambers, NHTSA proposes no changes to the end fitting corrosion resistance requirements/procedures in FMVSS No. 106.

#### 11. High Temperature Impulse Test

SAE J1401 specifies a hot impulse test in which a hose assembly is filled with brake fluid and subjected to 150 cycles of 1600 psi for one minute, then zero pressure for one minute, at an elevated temperature of 259 degrees F. After this test procedure, the hose assembly is cooled and subjected to a burst test with a specified minimum burst pressure of 5,000 psi. FMVSS No. 106 does not include a hot impulse test. Accordingly, NHTSA proposes incorporating the high temperature impulse test from SAE J1401 into FMVSS No. 106.

The table below summarizes the differences between the hydraulic brake hose requirements/procedures of FMVSS No. 106 and SAE J1401 and indicates which requirements/procedures NHTSA proposes incorporating into the standard.