

(b) *Preparation.* (i) Use the bend radius for the size of tubing being tested from Table VIII and cut the tubing to the following length:

$$3.14 \times [\text{bend radius}] + [10 \times [\text{nominal tubing OD}]] + 2 \text{ inches}$$

or

$$[3.14 \times [\text{bend radius}]] + [10 \times [\text{nominal tubing OD}]] + 50 \text{ mm}$$

(ii) Place a reference mark at the center of the sample. At this mark, measure the initial outside diameter of the tubing. If the tubing is slightly out-of-round, use the minor diameter as the initial outside diameter.

(iii) Install the tubing completely over the pins of the holding device so that the tubing is bent 180 degrees. Adjust the distance between the pins until the bent radius of the tubing is approximately equal to the bend radius for the size of tubing being tested from Table VIII.

(iv) Condition the holding device and tubing in an air oven at 230 °F for 24 hours. Remove the holding device and tubing and allow to cool at room temperature for thirty minutes.

(v) With the tubing still mounted to the holding device, measure the minor diameter of the tubing at the reference mark to determine the final outside diameter.

(c) *Calculation.* Calculate the percentage collapse of the outside diameter of the tubing as follows:

$$[\text{Initial Outside Diameter} - \text{Final Outside Diameter}] \div [\text{Initial Outside Diameter}] \times 100$$

S12.18 Ozone resistance test. Conduct the test specified in S6.8 using plastic air brake tubing.

S12.19 Oil resistance test.

(a) Utilize a plastic air brake tubing assembly or prepare a 12 inch length of tubing and install end fittings according to the end fitting manufacturer's instructions.

(b) Immerse the tubing assembly in ASTM 903 oil at 212 °F for 70 hours. Remove and allow to cool at room temperature for 30 minutes. Wipe any excess oil from the tubing assembly.

(c) Connect one end of the tubing assembly to a source of air pressure and plug the other end.

(d) Increase the pressure inside the tubing assembly at a constant rate to 80 percent of the burst strength pressure for the size of tubing being tested as specified in Table VIII within a period of 5 seconds.

S12.20 Tensile strength test. Conduct the test specified in S6.9 using a plastic air brake tubing assembly or an assembly prepared from a 12 inch length of tubing with the end fittings according to the end fitting manufacturer's instructions.

S12.21 Boiling water conditioning and tensile strength.

(a) *Apparatus.* Use the tension testing machine specified in S8.9. Equip the lower attachment point of the machine with a heated, open-top container. The container acts as the lower attachment point for a brake tubing assembly, or it may have a hole in the bottom for the lower attachment point of the machine to pass through the container provided that the hole is sealed water-tight to the machine.

(b) *Preparation.* Prepare an air brake tubing assembly with a free length of six inches in accordance with the end fitting manufacturer's instructions. The free length is measured from the innermost crimp, ferrule, taper, or other mechanical joint that secures the fitting to the tubing and spring guards and other appurtenances are disregarded for measurement purposes. Install the tubing assembly on the tension testing machine with the lower fitting plugged to prevent water from entering the tubing. Fill the container with distilled water so that 4 inches of exposed tubing is submerged. Heat the water until it boils. After the water has boiled continuously for 5 minutes, apply tension to the tubing assembly at a rate of 1 inch per minute travel of the moving head until either the tensile load in Table VIII for the size of tubing being tested is reached or the free length of the tubing assembly reaches 9 inches, whichever occurs first.

S12.22 Thermal conditioning and tensile strength.

(a) *Apparatus.* Use the tension testing machine specified in S8.9.

(b) *Preparation.* Prepare an air brake tubing assembly with a free length of six inches in accordance with the end fitting manufacturer's instructions. The free length is measured from the innermost crimp, ferrule, taper, or other mechanical joint that secures the fitting to the tubing and spring guards and other appurtenances are disregarded for measurement purposes. Subject the tubing assembly to four complete cycles of the following sequence:

(i) Condition the tubing assembly in an environmental chamber at minus 40 °F for 30 minutes. Remove from the chamber and allow to warm at room temperature for 30 minutes.

(ii) Condition the tubing assembly by submerging it in boiling water for 15 minutes. Remove and allow to cool at room temperature for 30 minutes.

Install the tubing assembly on the tension testing machine and apply tension to the tubing assembly at a rate of 1 inch per minute travel of the moving head until either the tensile load in Table VIII for the size of tubing

being tested is reached or the free length of the tubing assembly reaches 9 inches, whichever occurs first.

S12.23 Vibration resistance test.

(a) *Apparatus.* A vibration testing machine that supports a brake tubing assembly by its end fittings in approximately a straight line and includes the following features:

(i) One tubing assembly attachment point is fixed and the other moves in a plane perpendicular to a line projected between the attachment points. The movable attachment point moves in a linear direction and travels ½ inch total and at its midpoint of travel falls on a line projected between the attachment points. The movable attachment point has a cycle rate of 600 cycles per minute.

(i) The distance between the attachment points is adjustable to compensate for varying lengths of brake tubing assemblies.

(ii) The actuating mechanism for the movable attachment point is balanced to prevent introduction of machine vibration into the brake tubing assembly.

(iii) The machine has a compressed air supply system that pressurizes the air brake tubing assembly through one fitting while the other fitting is plugged. The machine's compressed air supply system includes a pressure gauge or monitoring system and an air flow meter.

(iv) The machine is constructed so that an air brake tubing assembly mounted on it can be conditioned in an environmental test chamber.

(b) *Preparation.* (i) Prepare an air brake tubing assembly with a free length of eighteen inches in accordance with the end fitting manufacturer's instructions. The free length is measured from the innermost crimp, ferrule, taper, or other mechanical joint that secures the fitting to the tubing and spring guards and other appurtenances are disregarded for measurement purposes.

(ii) Install the air brake tubing assembly on the vibration testing machine and, with the movable attachment point at the midpoint of its travel, adjust the distance between the attachment points so that they are ½ inch closer together than the distance at which the tubing assembly is taut.

(iii) With the tubing assembly inside the environmental chamber, supply compressed air to the tubing assembly at a pressure of 120 psig and maintain this supply pressure for the duration of the test. Set the temperature of the environmental chamber to 220 °F and initiate cycling of the movable attachment point. After 250,000 cycles,