

AERONAUTICAL MATERIAL SPECIFICATIONS

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

AMS 3380

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Revised

HOSE, POLYTETRAFLUOROETHYLENE
TFE Fluorocarbon Resin
Wire Braid Reinforced

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. TYPE: Flexible, smooth bore hose.
3. APPLICATION: Primarily for fluid lines operating at temperatures up to 450 F and pressures up to 1500 psi.
4. MATERIAL AND FABRICATION:
 - 4.1 Hose: Shall consist of a polytetrafluoroethylene tube and a corrosion resistant steel wire braid reinforcement.
 - 4.1.1 Tube: Shall be a seamless, continuous extrusion of virgin polytetrafluoroethylene resin. Base resin shall conform to ASTM D1457-56T, Type III. Pigments may be included in the compound from which the tube is extruded.
 - 4.1.2 Reinforcement: Shall be of 18 - 8 type corrosion resistant steel wire, uniform in quality and size, of sufficient strength to ensure that the hose will meet the requirements of this specification; it shall be well, evenly, and firmly braided, and shall be free from dirt, lumps, and irregularities of braid. Hose under 0.875 in. nominal ID shall have a single layer of braid; hose 0.875 in. and over nominal ID shall have two layers of braid.
5. TECHNICAL REQUIREMENTS:
 - 5.1 Tube: The tube, before braiding or with reinforcement removed, shall conform to the following requirements; tests shall be performed in accordance with listed ASTM methods insofar as practicable. The test of 5.1.5 will not be required for routine control.

5.1.1 Tensile Strength at 77 F $\pm$ 2, psi, min	ASTM D412-51T, except separation
Longitudinal, All sizes	2200 speed 2 in. per min., for sizes
Transverse, Sizes over 0.500 in. ID	1800 0.500 in. ID and under. ASTM
	D1457-56T for larger sizes.
 - 5.1.2 Elongation at 77 F $\pm$ 2, %, min 200 As for tensile strength |
 - 5.1.3 Specific Gravity at 77 F $\pm$ 2 2.13 - 2.16 ASTM D792-52, Method A. Add 2 drops of wetting agent to water. |
 - 5.1.4 Roll and Proof Pressure:
 - 5.1.4.1 Tube shall be passed through 6 sets of rollers so that it is subjected to the following sequence of diametral flexings; rollers shall be arranged to prevent inadvertent rotation of the tube.

- 5.1.4.1.1 Roller angles specified in the following table assume that the tube is in a horizontal position and that pressure of the first set of rolls is exerted vertically; angles given for the final three sets of rolls may be taken as either clockwise or counterclockwise from the vertical diameter of the tube. A tolerance of ± 2 deg is allowed on each roller angle.

Phase	Type of Action	Roller Angle, deg
A	Flattening	0
B	Flattening	90
C	Rounding	0
D	Flattening	45
E	Flattening	135
F	Rounding	45

- 5.1.4.1.2 Roller gaps shall be as specified below for each size; a tolerance of ± 0.003 in. will be allowed.

Hose Size	Flattening Gap	Rounding Gap
3	0.203	0.218
4	0.218	0.218
5	0.218	0.250
6	0.218	0.312
8	0.234	0.375
10	0.250	0.500
12	0.250	0.500
16Z	0.250	0.750
20Z	0.312	0.875
24Z	0.375	1.250

- 5.1.4.2 Tube, after rolling, shall not leak, burst, or show other evidence of malfunction when held at the pressure shown below for 2 min. using water or air as the test medium.

Size	Nominal ID Inches	Proof Pressure psi
3	0.125	300
4	0.188	275
5	0.250	250
6	0.313	195
8	0.406	160
10	0.500	145
12	0.625	110
16Z	0.875	70
20Z	1.125	50
24Z	1.375	30

- 5.1.5 Burst Pressure: Tube shall not burst at any pressure lower than twice the applicable proof pressure of 5.1.4.2 when pressure is applied at a rate of increase of 15,000 - 25,000 psi per min. using a suitable fluid as the test medium and with the tube suitably clamped so as to prevent leakage but to permit axial movement of the tube during test.

5.2 Hose: Specimens of suitable length but not less than 9 in. long, cut from the complete hose, with suitable end fittings attached shall conform to the following requirements; tests shall be performed in accordance with listed ASTM methods insofar as practicable. Only the tests of 5.2.1, 5.2.3 (air aged only), and 5.2.4 will be required for routine control. Unless otherwise specified, any suitable fluid may be used as the pressure test medium.

5.2.1 Proof Pressure:

5.2.1.1 Hose shall not leak, burst, or show other evidence of malfunction when held at the pressure shown below for not less than 30 sec and not more than 5 minutes.

Size	Nominal ID Inches	Proof Pressure psi
3	0.125	3000
4	0.188	3000
5	0.250	3000
6	0.313	3000
8	0.406	3000
10	0.500	3000
12	0.625	2000
16Z	0.875	2500
20Z	1.125	2000
24Z	1.375	2000

5.2.1.2 Hose shall not leak when given a final check by immersing in water and applying a pressure of 1050 psi $\pm$ 50 using air or nitrogen gas as the test fluid.

5.2.2 Change In Length Under Pressure: Hose shall not change in length by more than +0.20 in. or -0.30 in. in 10 in. when subjected to the operating pressure shown below for not less than 5 minutes. Hose shall be held in a straight, unpressurized condition, a 10 in. gage length marked off on the hose and the hose pressurized. After 5 min. and while still pressurized, the gage length shall be remeasured and the change in length calculated.

Size	Nominal ID Inches	Operating Pressure psi
3	0.125	1500
4	0.188	1500
5	0.250	1500
6	0.313	1500
8	0.406	1500
10	0.500	1500
12	0.625	1000
16Z	0.875	1250
20Z	1.125	1000
24Z	1.375	1000

5.2.3 Impulse Test: Hose shall not burst, loosen, leak, or show other evidence of malfunctioning, when subjected to 100,000 impulse cycles at 400 F as follows:

- 5.2.3.1 Two hoses filled with di-2-ethylhexyl sebacate +0.5% phenothiazine but under no pressure, and two hoses empty and open shall be aged in an air oven for 168 hr at $400\text{ F} \pm 10$ and then used for test. The oil aged and air aged hoses shall be subjected to proof pressure of 5.2.1 for not less than 5 min. before being installed in the impulse tester.
- 5.2.3.2 Hoses of size 12 and smaller shall be bent to the bend radius of 5.2.7 and assembled in the impulse tester in this position with both ends connected to rigid supports. Larger sizes shall be installed straight; one end may be left free.
- 5.2.3.3 Using di-2-ethylhexyl sebacate +0.5% phenothiazine as the test fluid and with temperature of test fluid at $400\text{ F} \pm 5$ and the ambient air at $400\text{ F} \pm 10$, hose shall be subjected to 100,000 cycles of impulse applied at frequency of 35 cpm. Electronic devices shall be used to determine and control the impulse pressures within the limits shown in Fig. 1. Peak pressure for sizes 16Z and smaller nominal ID shall be 125% of operating pressure of 5.2.2; peak pressure for the 20Z and 24Z sizes need not exceed 1000 psi.
- 5.2.4 Oil Resistance: Hose shall not leak, burst, loosen, or show other evidence of malfunction at any time during the following sequence of tests:
- 5.2.4.1 Two hoses shall be filled with di-2-ethylhexyl sebacate +0.5% phenothiazine and heated in an oven at $450\text{ F} \pm 10$, with internal pressure in the hose equal to the rated operating pressure of 5.2.2, for not less than 20 hours. Pressure shall be released and the hose removed from the oven.
- 5.2.4.2 Hose shall be drained and refilled with ASTM Reference Fuel B and pressure equal to the rated operating pressure of 5.2.2 again applied and maintained for not less than 2 hours.
- 5.2.4.3 The procedures of 5.2.4.1 and 5.2.4.2 shall be repeated twice (a total of 3 complete cycles).
- 5.2.4.4 At the completion of the above tests, hose shall be filled with di-2-ethylhexyl sebacate +0.5% phenothiazine and held in a cold chamber at $-65\text{ F} \pm 2$ for 4 hours. While at this temperature, hose shall then be subjected to the rated operating pressure of 5.2.2 for not less than 5 min. and the pressure then released. Pressurization and release shall be repeated for a total of 10 cycles with not less than 5 min. between each pressurization.
- 5.2.4.5 The hoses shall then be held in the cold chamber at $-65\text{ F} \pm 2$ for an additional 24 hours. At the end of the 24 hr, di-2-ethylhexyl sebacate +0.5% phenothiazine at $450\text{ F} \pm 10$ shall be introduced into the hoses and within 15 sec thereafter pressure shall be raised to the proof pressure of 5.2.1 and maintained for not less than 2 minutes.
- 5.2.4.6 At the conclusion of the test of 5.2.4.5, one hose shall be subjected to the burst pressure test of 5.2.5 and the other to the flexibility and vacuum tests of 5.2.7 and 5.2.8.

- 5.2.5 Burst Pressure (Room Temperature): Hose shall not burst, leak, loosen, or show evidence of malfunction at any pressure lower than the values specified below when pressure is applied at a rate of increase of 15,000 - 25,000 psi per min., with hose extended straight and the free end unrestrained.

Size	Nominal ID Inches	Burst Pressure psi
3	0.125	12,000
4	0.188	12,000
5	0.250	10,000
6	0.313	9,000
8	0.406	8,000
10	0.500	7,000
12	0.625	6,000
16Z	0.875	5,000
20Z	1.125	4,000
24Z	1.375	4,000

- 5.2.6 Burst Pressure (High Temperature): Hose shall not burst, leak, loosen, or show other evidence of malfunction at any pressure lower than the values specified below when tested as follows: Hose shall be filled with di-2-ethylhexyl sebacate +0.5% phenothiazine at 450 F $\pm$ 10 and maintained in ambient atmosphere at that temperature for 1 hour. At the end of this period and while still maintained at 450 F $\pm$ 10, pressure shall be applied up to the rated operating pressure of 5.2.2 and held for not less than 5 min.; pressure shall then be raised at a rate of increase of 15,000 - 25,000 psi per min. until failure.

Size	Nominal ID Inches	Burst Pressure psi
3	0.125	7500
4	0.188	7000
5	0.250	6500
6	0.313	6500
8	0.406	6000
10	0.500	5500
12	0.625	4000
16Z	0.875	3500
20Z	1.125	3000
24Z	1.375	3000

- 5.2.7 Flexibility: Hose filled with ASTM Reference Fuel A and held at -65 F $\pm$ 2 for not less than 24 hr shall withstand, while still at -65 F $\pm$ 2, being bent around the radius given below, straightened, bent equally in the opposite direction, and restraightened 5 times, allowing approximately 1/4 sec per cycle, without cracking, breaking, or splitting.

Size	Nominal ID Inches	Bend Radius Inches
3	0.125	2
4	0.188	2
5	0.250	2
6	0.313	4
8	0.406	4-5/8
10	0.500	5-1/2
12	0.625	6-1/2
16Z	0.875	7-3/8
20Z	1.125	11
24Z	1.375	14

5.2.8 Vacuum: The same hose used for the test of 5.2.7 shall then be subjected to the following test without collapsing to the extent that a ball of the specified diameter will fail to pass through the hose and without showing other permanent damage.

5.2.8.1 Hose shall be drained and placed in an oven at 450 ± 10 , with negative pressure equal to 28 in. of Hg for sizes 12 and smaller, 20 in. for sizes 16Z and 20Z, and 14 in. for size 24Z applied, for not less than 4 hours. Hose shall be removed from the oven while continually maintaining the negative pressure until hose has cooled to room temperature. Pressure shall be restored to normal and the hose inspected for collapse and other damage. Fittings shall be cut from one end of the hose and a ball of the diameter specified below allowed to roll the full length of the hose.

Size	Nominal ID Inches	Ball Diameter Inches
3	0.125	0.076 - 0.080
4	0.188	0.125 - 0.132
5	0.250	0.187 - 0.193
6	0.313	0.250 - 0.255
8	0.406	0.332 - 0.337
10	0.500	0.421 - 0.426
12	0.625	0.531 - 0.538
16Z	0.875	0.770 - 0.778
20Z	1.125	0.996 - 1.004
24Z	1.375	1.246 - 1.252

5.2.9 Volumetric Expansion: Shall be not greater than the following when determined in accordance with ASTM D571-55 at a pressure of 1000 psi.

Size	Nominal ID Inches	Volumetric Expansion cc per in. free length
3	0.125	0.028
4	0.188	0.028
5	0.250	0.040

6. QUALITY: The product shall be uniform in quality and condition, clean, smooth, and free from foreign materials and from imperfections detrimental to fabrication, appearance, or performance of parts.