

PLASTIC FUEL AND VAPOR LINES, PLASTIC FUEL FILTERS, PLASTIC CLIPS AND STUDS

GM6264M

1 SCOPE. This specification covers product requirements for extruded plastic fuel and vapor lines, plastic fuel filters, and plastic clips and studs.

1.1 Other documents which describe the performance and dimensional requirements of these components and assemblies manufactured from these components are GM9060P, GM9080P, and Chart #10093203.

1.2 The material specifications defining the requirements for the raw materials used for components released to the GM6264M specification are GMP.PA12.002, GMP.PA12.003, GMP.PA12.004, and GMP.PA12.005.

2 REFERENCED STANDARDS.

GM6268M	GM9061P	GMP.PA12.004
GM9032P	GM9080P	GMP.PA12.005
GM9055P	GMP.PA12.002	SAE J400
GM9060P	GMP.PA12.003	

3 LIMITATIONS.

3.1 Parts made from these materials should not be exposed to peak intermittent temperatures greater than 115°C, or continuous usage temperatures greater than 90°C.

3.2 Only virgin material is to be used for fuel and vapor lines, filters, clips and studs.

3.3 The amount of carbon black is limited to a range of 0.30% to 0.50% with the carrier being of the same base resin as the fuel and vapor line, filter, clip, or stud material.

3.4 Unless otherwise noted, for all test procedures, all test temperatures shall be held to $\pm 2^\circ\text{C}$, all test pressures to ± 35 kPa, and all test sample lengths to ± 5.0 mm.

4 TEST PROCEDURES - EXTRUDED PARTS.

For testing of the nylon tubing to 4.5 through 6.1 of the specification, each type of connection used in a design released to this specification must be incorporated into the samples tested to 4.5, 4.6, 4.7, 4.8, 4.10, and 4.11. If fuel filters are incorporated into a design, they must be incorporated into the samples tested to 4.10 and 4.11.

4.1 All sizes of extruded tubing incorporated into a design released to this specification must be tested to all of the requirements of this specification.

4.2 For extruded tubing of 12.50 mm ID, used for low pressure (≤ 6.9 kPa max operating pressure), low temperature ($\leq 90^\circ\text{C}$ max intermittent temperature) applications, such as for fuel filler vent tube applications, testing to 4.6 and 5.2 is not required. Exceptions to test performance requirements for 12.50 mm ID tubing used for such applications for other test procedures are noted in the sections of the specification describing those test procedures.

4.3 For nylon fuel tubing assemblies that consist of cross-head extruded sleeving assemblies, testing to 4.7, 4.8, and 5.2 is not required. For test of the tubing from these assemblies to the requirements of 4.12, removal of the crosshead extruded sleeving from the tubing prior to test is required.

4.4 Where there is a reference in the specification to a minimum bend diameter, the values listed in Table 1 shall be used. The tubes are to be bent in a free state until they form an oval, then the free ends are grasped, wrapped over the first loop of tubing, and secured to form a two-layered coil of nylon tubing. The coil is secured, preferably with copper wire, at the points shown in Figure 1. The measurement of the minimum bend diameter is made from inside wall to inside wall of the coil of nylon tubing (inner diameter).

**TABLE 1 - DIMENSIONS AND TOLERANCES, mm
(SECTION 4)**

Nominal OD	Inside dia	Wall Thickness	Bend dia, min	Tubing Length
6.35	3.89-4.14	0.98-1.41	76.2	450
7.93	6.20-6.50	0.90-1.15	101.6	630
9.53	7.90-8.20	0.90-1.15	152.4	870
15.30	12.35-12.65	1.20-1.60	236.3	1330

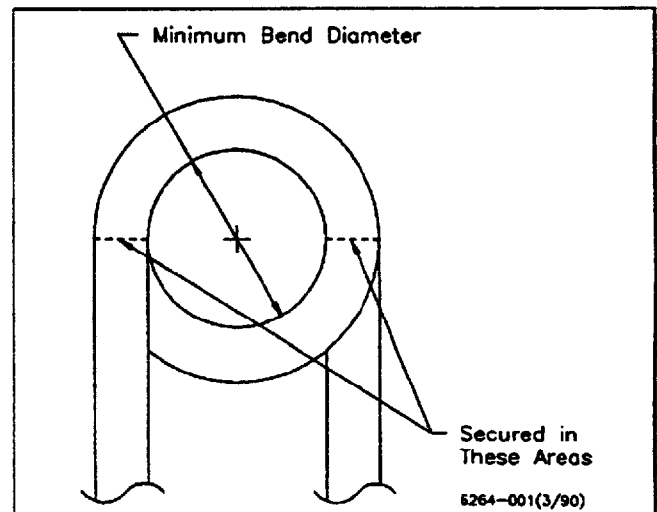


FIGURE 1 - SECTION

4.5 BURST TEST.

4.5.1 Test Procedure. The test apparatus consists of a suitable source of hydraulic pressure and the necessary gages and piping. The length of the tubing should be 305.0 ± 5.0 mm. Plug one end of the test specimen and mount in the apparatus with the other end unrestrained. The tubing is stabilized for 1

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to 3 h at 24°C. Pressure is applied at room temperature, $24 \pm 2^\circ\text{C}$, at a constant rate so as to reach the specified minimum burst pressure within a time period of 10 to 15 s. Fittings shall not separate from the tubing nor shall the assembly visibly leak at less than the specified minimum burst pressure.

4.5.2 Acceptance Determination. The minimum burst pressure shall be 3100 kPa. For 12.50 mm tubing used for low pressure applications (≤ 6.9 kPa max operating pressure), low temperature applications ($\leq 90^\circ\text{C}$ max intermittent temperature), the minimum burst pressure shall be 1035 kPa.

4.6 HIGH TEMPERATURE BURST TEST.

4.6.1 Test Procedure. The test apparatus consists of a suitable source of hydraulic pressure and the necessary gages and piping. The oil should be at $125 \pm 1^\circ\text{C}$. The length of the tubing should be 305.0 ± 5.0 mm. Plug one end of the test specimen and mount in the apparatus with the other end unrestrained. The tubing shall be stabilized for 1 h at 125°C . Pressure is applied at 125°C at a constant rate so as to reach the specified minimum burst pressure within a time period of 10 to 15 s. Fittings shall not separate from the tubing nor shall the assembly visibly leak at less than the specified minimum burst pressure. For 12.50 mm tubing used for low pressure, low temperature applications, there is no high temperature burst requirement.

4.6.2 Acceptance Determination. The minimum burst pressure shall be 1380 kPa.

4.7 RESISTANCE TO ZINC CHLORIDE TEST.

4.7.1 Test Procedure. The sample is bent to the minimum bend diameter and immersed in a 50% aqueous solution (by weight) of zinc chloride for 200 h at $23 \pm 2^\circ\text{C}$. All interfaces between the nylon tubing and the components directly connected to the tubing must also be immersed for the duration of the test when performing this procedure. The ends of the assembly are to remain unplugged. The sample is removed from the solution and burst tested per 4.5. The sample may be rinsed with fresh water to clear salt residue from the tubing before bursting.

4.7.2 Acceptance Determination. There shall be no visible cracks or crazing in the sample. Sample must meet Burst Test requirement of 4.5.

4.8 RESISTANCE TO CALCIUM CHLORIDE TEST.

4.8.1 Test Procedure. The sample is bent to the minimum bend diameter and immersed in a 50% aqueous solution (by weight) of calcium chloride for 200 h at $60 \pm 2^\circ\text{C}$ and 200 h out of solution at $60 \pm 2^\circ\text{C}$. All interfaces between the nylon tubing and the components directly connected to the tubing must also be immersed for the duration of the test when performing this procedure. The ends of the assembly are to remain unplugged. The sample is removed from the solution and burst tested per 4.5. The sample may be rinsed with fresh water to clear salt residue from the tubing immediately before the burst test.

4.8.2 Acceptance Determination. There shall be no visible cracks or crazing in the sample. Sample must meet Burst Test requirement of 4.5.

4.9 COLD TEMPERATURE FLEXIBILITY TEST.

4.9.1 Test Procedure. The sample, consisting of a 305.0 ± 5.0 mm length of tubing, is exposed in an air circulating oven at $110 \pm 2^\circ\text{C}$ for 24 h. The sample is removed from the oven and within 30 minutes exposed for 4 h at $-40 \pm 2^\circ\text{C}$. A mandrel having a diameter equal to 12 times the nominal diameter (nominal OD) of the tubing is also exposed for 4 hours at $-40 \pm 2^\circ\text{C}$. In order to obtain uniform temperatures the tubing and mandrel may be supported by a nonmetallic surface during the entire period of the exposure. Immediately following this exposure, the tubing is bent 180° over the mandrel, with this bending motion completed within a period of 4 to 8 s. For 12.50 mm ID tubing, the sample length shall be 610.0 ± 5.0 mm.

4.9.2 Acceptance Determination. The tubing shall show no evidence of fracture.

4.10 SOUR GASOLINE RECIRCULATION TEST.

4.10.1 Test Procedure. The assembly is exposed to recirculating sour gasoline (Indolene HO-III/T-Butyl Hydroperoxide Mixture) with a peroxide number of 50 (at a rate of 700 mL/minute for tubing of ID ≥ 6.35 mm and 300 mL/minute for tubing of ID < 6.35 mm) and a temperature of $40 \pm 2^\circ\text{C}$ for 6 weeks on a test apparatus as shown in Figure 2 with a modified fuel reservoir as shown in Figure 3 according to the following procedures:

- a. Connect the test sample as per the fuel recirculation test (See Figure 2). The fuel filter is inserted between the flow meter and the fuel reservoir.
- b. Add 3600 mL of indolene and then mix 10 mL of 90% T-Butyl Hydroperoxide.
- c. Turn on the pump and the heater. Wait 1 h, then remove 5 mL of fuel for the peroxide number measurement per GM9055P. The peroxide number should equal 50 ± 3 initially.
- d. Set the flow rate at 700 mL/minute ± 70 mL/minute for tubing with ID > 6.36 mm, 300 mL/minute ± 30 mL/minute for tubing with ID < 6.35 mm.
- e. Maintain the temperature at $40 \pm 2^\circ\text{C}$.
- f. Measure the peroxide number twice each week.
- g. Run the test for 6 weeks changing the sour gasoline after the first 24 h and thereafter:

1. When the peroxide number is less than 40 or greater than 55, or,
2. Once a week if the peroxide number remains between 40 and 55.

- h. Correct for evaporative losses when necessary by adding sour gasoline of peroxide number = 50 ± 3 .

4.10.2 Acceptance Determination. After 6 weeks of sour gasoline exposure, the samples shall meet the requirements of the following tests conducted sequentially:

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- a. The maximum tubing length change permitted = 2.0%.
- b. Sample must be leak tested per GM9080P, 4.1, and must meet all of these requirements, with the following exceptions:
 1. System to be pressurized with air to 70 ± 7 kPa.
 2. Maximize air leakage permitted ≤ 2.0 cc/minute.
- c. Sample must be leak tested per GM9080P, 4.1, and must meet all of the requirements of 4.1.

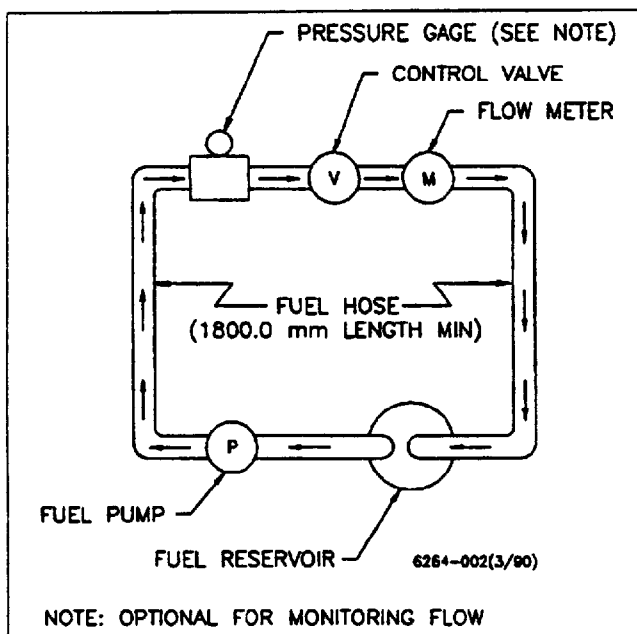


FIGURE 2 - FUEL C RECIRCULATION APPARATUS

- d. Sample must be tested per GM6264M, 4.9 (Cold Flexibility Test), omitting the 110°C oven-age step, and must meet all requirements of 4.9.
- e. Sample must be tested per GM6264M, 4.5 (Burst Test), and must meet all requirements of 4.5.

4.11 FUEL RESISTANCE - RECIRCULATION TEST.

4.11.1 Test Procedure. Expose the sample to recirculating ASTM Reference Fuel C (at a rate of 700 mL/minute $\pm$ 70 mL/minute for tubing of ID $\geq$ 6.35 mm, and 300 mL/minute $\pm$ 30 mL/minute for tubing of ID $<$ 6.35 mm) at 12°C min for 6 weeks, using the test apparatus as shown in Figure 2. The fuel filter shall be inserted between the flow meter and the fuel reservoir. The recirculating fuel is to be replaced with fresh Fuel C every week.

4.11.2 Acceptance Determination. After 6 weeks of Fuel C exposure, the samples shall meet the requirements of the following tests conducted sequentially:

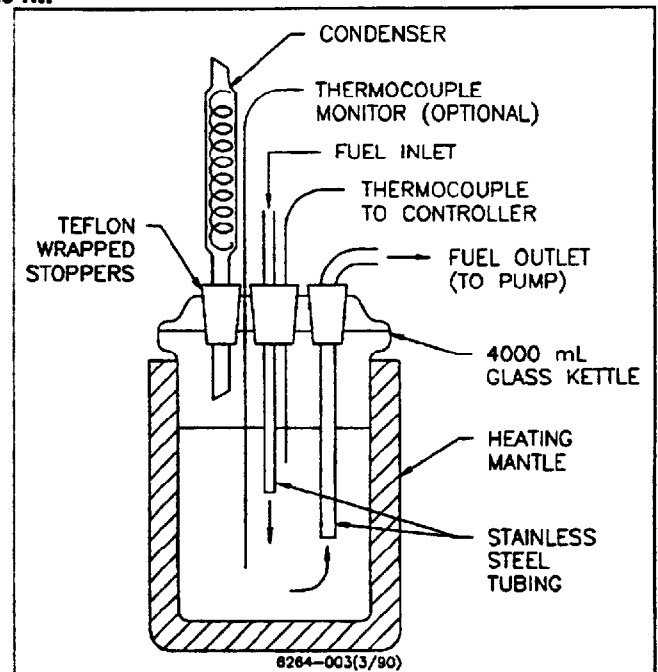


FIGURE 3 - SOUR GASOLINE FUEL RESERVOIR

- a. The maximum tubing length change permitted = 2.0%.
- b. Sample must be leak tested per GM9080P, 4.1, and must meet all of these requirements, with the following exceptions:
 1. System to be pressurized with air to 70 ± 7 kPa.
 2. Maximize air leakage permitted ≤ 2.0 cc/minute.
- c. Sample must be leak tested per GM9080P, 4.1, and must meet all of the requirements of 4.1.
- d. Sample must be tested per GM6264M, 4.9 (Cold Flexibility Test), omitting the 110 °C oven-age step, and must meet all requirements of 4.9.
- e. Sample must be tested per GM6264M, 4.5 (Burst Test), and must meet all requirements of 4.5.

4.12 COLD IMPACT TEST.

4.12.1 Test Procedure. Test Fixture must conform to Figure 4 requirements and the specific test procedures and equipment used must have GM Engineering approval. Sample length to be 305.0 $\pm$ 5.0 mm. The tubing sample is exposed to -40°C for 4 h. The impact test apparatus described by Figure 4 is exposed to -40°C for a minimum of 1 h at -40°C. The impact must be performed at -40°C. The sample is inserted into the test apparatus, and impacted by allowing the head to fall 305.0 $\pm$ 3.0 mm. The sample is allowed to return to 24 $\pm$ 2°C within 30 $\pm$ 5 minutes, and then subjected to a room temperature Burst Test per 4.5. The following requirements for the test must be met: