# QC

AUTOMOBILE INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

# QC/T 798-2008

# Multilayers plastic tubing for automotive fuel system

汽车用多层塑料燃油管

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**Annex:**

**Standard numbers, descriptions and dates coming into force of four automotive industry standards**

| SN | Standard number | Standard description | Date coming into force |
|---|---|---|---|
| 1 | QC/T 796-2008 | Automotive fuel consumption labels | July 1, 2008 |
| 2 | QC/T 797-2008 | Identification and marking of materials that are fabricated into automotive plastic, rubber and thermoplastic elastomer parts | July 1, 2008 |
| 3 | QC/T 798-2008 | Multi-layers plastic tubing for automotive fuel system | July 1, 2008 |
| 4 | QC/T 799-2008 | Telescopic belt truck conveyer | July 1, 2008 |

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# Multilayers plastic tubing for automotive fuel system

## 1 Scope

This standard specifies the dimensional specifications, appearance, technical requirements, test methods, inspection rules, markings, packaging, transportation, storage of multilayer plastic tubing for automotive fuel systems (hereinafter referred to as multilayer tubing) and tube assemblies.

This standard is applicable to multilayer plastic fuel tubes which have a working temperature between -40 °C and +115 °C (continuous use temperature shall not exceed 90 °C) and maximum working pressure of not more than 0.7 MPa.

## 2 Normative references

The provisions in following documents become the provisions of this standard through reference in this standard. For the dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this standard; however, parties who reach an agreement based on this standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB/T 528-1998 Determination of tensile stress-strain properties of vulcanized rubber or thermoplastic rubber

GB/T 528-1998 Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties (ISO 527 -2: 1993 IDT)

GB/T 2828.1-2003 Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection (ISO 2859-1:1999 IDT)

GB/T 2918-1998 Plastics - Standard atmospheres for conditioning and testing (ISO 291:1997 IDT)

## 3 Terms and definitions

The following terms and definitions apply to this standard.

**3.1**

**Multilayer plastic tubing**

More than two layers of non-metallic plastic tubes which are made of materials of different properties and different types, without connectors.

**3.2**

**Tube assemblies**

A combination of a multilayer tube and a tube joint which have a specified length and shape.

# 4 Specification dimension

## 4.1 Structure

The multilayer tube is a multilayer structure which contains the wall-thickness of the main body. The name of material is generally indicated on the drawing. If specified, it shall identify each layer of all tube layers.

## 4.2 Dimensions and tolerances

Table 1 provides the dimensions and wall-thickness of various types of multilayer tubes of this standard. The thickness and tolerance for each layer may be determined by the manufacturer and the user through negotiation. The dimensions and tolerances of the multilayer tube are indicated by mm.

## 4.3 Wall-thickness

Multilayer tubes of different sizes which are made by materials of different grades have different wall-thicknesses. The minimum wall-thickness of a straight tube which has a nominal diameter equal to 10 mm is 0.9 mm. The larger the nominal diameter, the larger the wall-thickness. The requirements for wall-thickness are as detailed in Table 1.

Note: Some of the following factors influence the choice of wall-thickness:

a) High burst-pressure requirements mean higher wall-thickness requirements;

b) The thicker the wall-thickness, the greater the minimum bending radius.

# 6 Performance requirements

The performance requirements of the multilayer and/or multilayer tube assembly shall comply with the requirements of Table 2.

**Table 2 -- Performance requirements**

| No. | Test items | | Unit | Requirements | | Test methods |
|---|---|---|---|---|---|---|
| 1 | Burst-pressure | Burst-pressure at room-temperature | MPa | The minimum burst-pressure shall be greater than or equal to 8 times the design working pressure in the system. Before reaching to this pressure, the tube does not loose and the assembly does not leak | | 7.3 |
| | | Burst-pressure at high-temperature | MPa | The minimum burst-pressure shall be greater than or equal to 3 times the design working pressure in the system. Before reaching to this pressure, the tube does not loose and the assembly does not leak | | 7.4 |
| 2 | Bending performance | Minimum bending radius | mm | Meet the requirements of Table 3 | | 7.5 |
| | | Anti-bending deformation | - | The steel ball can pass it freely | | |
| | | Burst pressure after bending | MPa | The minimum burst-pressure shall be greater than or equal to 8 times the design working pressure in the system | | |
| 3 | Resistance to zinc chloride | Appearance | - | Multilayer tube or tube end shall be free of cracks | | 7.6 |
| | | Burst-pressure at room-temperature | MPa | The minimum burst-pressure shall be greater than or equal to 75% of the burst-pressure at room-temperature | | |
| 4 | Impact performance at low-temperature | Appearance | - | The surface is free of cracks | | 7.7 |
| | | Burst-pressure at room-temperature | MPa | The minimum burst-pressure shall be greater than or equal to 75% of the burst-pressure at room-temperature | | |
| 5 | Resistance to permeability [a] | Permeability | g/m•d | OD ≤ 10 mm | < 0.05 | 7.8 |
| | | | | 10 mm < OD ≤ 18 mm | < 0.15 | |
| | | Change rate of length | - | -1% ~ +1% | | |
| | | Burst-pressure at room-temperature | MPa | Meet the requirements of the burst test pressure at room-temperature | | |
| 6 | Yield stress | Extruding direction | $N/mm^2$ | ≥ 24 | | 7.9 |
| | | Perpendicular direction | | ≥ 25 | | |
| | Elongation at break | Extruding direction | % | ≥ 170 | | |
| | | Perpendicular direction | | ≥ 170 | | |
| 7 | Resistance to fuel | Appearance | - | The surface is free of cracks | | 7.10 |
| | | Impact at low-temperature | - | The surface is free of cracks | | |

**7.3.3.1** At the ambient temperature of 23 °C ± 2 °C, carry out the test. The internal test medium of the multilayer tube is liquid. Block one end of the specimen. Connect the other end to the burst pressure testing machine. Then at the rate of 7 MPa/min ± 1 MPa/min, increase pressure to the multilayer tube, until it bursts. Record the maximum pressure during the test period. Use the minimum value of the five specimens as the test result.

**7.3.3.2** If the tubing/connection fails before reaching the burst-pressure, discard the test data. If necessary, it may use the existing tubing connections plus the auxiliary fixtures, to ensure that the test is carried out effectively.

**7.3.3.3** The minimum burst-pressure of all specimens shall be greater than or equal to 8 times the design working pressure in the system. If the design working pressure is not known, record the measured burst-pressure, which can be used to compare with the requirements in application state. The end user shall discuss establishing the maximum pressure $P_{max}$ in the system when the multilayer tube is in the use state.

**7.4 Burst-pressure at high-temperature**

**7.4.1** Specimen: Five tube assemblies which have a length of 300 mm between the tubes.

**7.4.2** Test device: Burst-pressure testing machine.

**7.4.3** Test procedure:

**7.4.3.1** After the state conditioning, the specimen shall be kept at 115 °C for 0.5 h ~ 1 h and then tested according to the test procedure of 7.3.3.

Note: The liquid used in this burst pressure test shall also be at the same temperature.

**7.4.3.2** The minimum burst-pressure of all specimens shall be greater than or equal to 3 times the design working pressure in the multilayer tube system. The end user shall discuss establishing a maximum pressure value, to allow the multilayer tube to deliver a particular liquid or is possible in a vapor system.

The recommended minimum burst-pressure at high-temperature is: Not less than 1.286 MPa for the high-pressure liquid fuel line; not less than 0.143 MPa for the low-pressure liquid fuel line; not less than 0. 057 MPa for the fuel vapor tube.

**7.5 Bending performance**

**7.5.1** Determination of the minimum bending radius.

**7.5.1.1** Calculation of the minimum bending radius: Table 3 gives the empirical

products;

b) After formal production, where there are large changes in structure, materials, processes that may affect the product's performance;

c) When the production is restored after long-term suspension;

d) For products manufactured in batches or mass, not less than once a year;

e) When the exit-factory inspection result is significantly different from the previous type inspection result;

f) When the national quality supervision agency proposes the requirements for type inspection.

**8.4.2** Sampling:

The multilayer tubes of the same specification which are continuously produced at the same production site, by the same raw material, equipment and process are considered as a batch. The products to be type inspected shall be taken from the same batch of products that have passed the exit-factory inspection. The sampling plan shall be agreed by the supplier and the buyer.

**8.4.3** The items of type inspection are all items as specified in clauses 5 and 6.

### 8.5 Determination of qualification

Use the test method as specified in this standard to carry out inspection. Based on the test results and technical requirements, make quality determination against the product. If there is one disqualified item, it allows to double the number of products to repeat testing for this item. If it is still disqualified, this batch of products are disqualified. If it fails to reach the requirements, randomly take double number of samples to re-inspect this item. If it is still disqualified, this batch of products is disqualified.

## 9 Markings and signs

### 9.1 Markings on multilayer tube

The markings on the multilayer tube shall be clear and firm, which shall not impair the performance of the multilayer tube and the function of the connecting elements. The spacing between markings shall not exceed 300 mm. The information of the marking on the multilayer tube shall have at least the following:

a) This standard number;

b) Specifications of multilayer tube; nominal diameter (OD) and wall-

# Appendix A

## (Normative)

### Specifications for permeability resistance test

**A.1 General**

This Appendix specifies test equipment, methods and procedures, calculation formulas and reports for the permeability resistance of multilayer tubes.

**A.2 Test equipment**

- Gas analyzer;
- Explosion-proof drying oven;
- Burst pressure testing machine;
- Liquid circulation test machine;
- Vernier calipers (0 -500 mm/0.02 mm), etc.

**A.3 Test conditions**

**A.3.1** Test medium: test liquid (90% volume of high-quality lead-free gasoline + 10% volume of ethanol).

**A.3.2** Test conditions:

- Test environment: temperature: 23 °C ± 2 °C, relative humidity: 50% ± 10%;
- Relative working pressure: 0.35 MPa ± 0.01 MPa;
- Test medium's temperature: 40 °C ± 2 °C;
- Flow rate: 30 L/h ± 5 L/h;

**A.3.3** Burst-pressure test: The internal medium of the specimen is water (23 °C ± 2 °C). The specimen is placed in an explosion-proof drying box which has an ambient temperature of 100 °C ± 5 °C.

**A.4 Test procedure**

**A.4.1** The connection diagram of permeability resistance test is as shown in Figure A.1. Connect the specimen to the connector. Measure the length between the two connectors or the length between the two markings on the part assembly (the length between the markings is at least 500 mm). Record it as

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