



Low Pressure Tube for Brake Boosters

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Scope. This standard covers the requirements for low pressure tubes for brake boosters.

1.1.1 The thermoplastic tube with an inner layer made of Polyamide (nylon) 6, (PA6) shall not be used in combination with zinc-plated metal fittings (risk of stress cracking).

1.1.2 Direct contact between the thermoplastic tube and materials containing chlorine, as for example adhesive tapes made of Polyvinyl Chloride (PVC) is not allowed, because nascent chlorine resulting from high temperature decomposition may cause cracks in the PA12 tube.

1.2 Mission/Theme. Not applicable.

1.3 Classification.

1.3.1 Type. Two material classifications are defined based on the range of operating temperatures tolerated (see Table 1).

Table 1: Temperature and Relative Humidity Range

	Type A	Type B
Minimum Temperature	-40 °C	
Maximum Sustained Temperature > 10 minutes	+110 °C	+140 °C
Maximum Excursion Temperatures < 10 minutes	+120 °C	+150 °C
Relative Humidity Range	(0 to 100) %	

1.3.2 Tube Diameter. The following tube diameter sizes are applicable (see Table 2):

Table 2: Code and Tube Diameters

Code	Outer Tube Diameter in mm
9	$9 \pm 0.15 \times 1.5 \pm 0.15$
12	$12 \pm 0.15 \times 1.5 \pm 0.15$
12.5	$12.5 \pm 0.15 \times 1.25 \pm 0.15$

Note: These specifications are valid for the smooth area of the tube.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

DIN 73378	EN 14214	ISO 188	ISO 1431-1
DIN 53758	ISO 178	ISO 527-1	ISO 1817
EN 590	ISO 179	ISO 527-2	SAE J2260

2.2 GM Standards/Specifications.

GMW3059	GMW14728	GMW16331
GMW14914	GMW15399	L 000 0125
GMW14562	GMW16177	

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.1.3 Facilities. According to the relevant test procedure.

3.1.4 Equipment. According to the relevant test procedure.

3.1.5 Test Vehicle/Test Piece. If not otherwise stated, the size, dimensions, and number of test pieces shall be as specified in the relevant test procedures for the property concerned.

3.1.5.1 For the tests according to paragraphs 4.3.8 thru 4.3.12, the mechanical specified value of yield stress (paragraph 4.3.1) and strain at break (paragraph 4.3.2) shall be used as reference.

3.1.6 Test Time. Not applicable.

3.1.7 Test Required Information. Not applicable.

3.1.8 Personnel/Skills. Not applicable.

3.2 Preparation. Not applicable.

3.3 Conditions.

3.3.1 Environmental Conditions. Unless otherwise specified in the relevant tests, tests shall be performed in the as received condition after storage at $(+23 \pm 5) ^\circ\text{C}$ and $(50 \pm 6) \%$ relative humidity for ≥ 48 h without any pre-conditioning.

3.3.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

3.4 Instructions. Not applicable.

3.5 Data. Not applicable.

3.6 Safety. This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

3.7 Documentation. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

3.7.1 Test Results. The results of the tests shall be summarized in a test report.

4 Requirements and Procedure

4.1 General.

4.1.1 Material. The single components shall be made of one material each. These materials shall have an additional, particularly effective stabilization to avoid the degradation by oxidation of the material in hot air. These materials shall also be resistant against Ultraviolet (UV) radiation and blow-by-gas.

Note: The used materials shall be documented according to GMW3059.

4.1.2 Appearance. In the as-received condition, the single components shall be free from manufacturing faults (e.g., blisters, voids, inhomogeneities, foreign substances).

4.1.3 Dimensions. Dimensions as specified on the part drawing.

4.1.3.1 For Tube only. If not otherwise specified on the part drawing, the tolerance for diameter and for the wall thickness shall be according to paragraph 1.3.2.

4.1.4 Color. The coloration of the outer layer shall be uniform. Color according to part drawing.

Note: The physical and mechanical characteristics may not be impaired by the coloration.

4.1.5 Ultra Violet (UV) Stabilization. A sufficient stability against exposure to sunlight (UV radiation) is required.

4.1.6 Operating Characteristics. A sufficient stability against heat ageing is required.

Note: The operating peak temperatures can be up to 100 h total in the life of the vehicle.

4.1.6.1 Materials are classified based on the range of operating temperatures tolerated, as Type A or Type B (see paragraph 1.3.1).

4.1.7 Part Identification. The tubes shall be marked according to GMW16331.

4.2 Characteristics.

4.2.1 Extruded Thermoplastic Connecting Tube. The characteristic properties of the tube shall be as specified in Table A1. The required test procedures are specified in paragraph 4.3.

Note: All requirements shall be met by any part of the tube. Each measurement shall meet the required values. All requirements shall be met by the molded part.

4.2.2 Connectors and Fittings. Materials shall be according to part drawing. The materials shall be selected in accordance with the operating temperature range.

Note: Joint technology of connectors and fittings see part drawing.

4.2.3 Check Valve. The check valve shall fulfill the requirements of GMW14562.

4.3 Test Procedures.

4.3.1 Yield Stress, according to ISO 527-1 and ISO 527-2.

4.3.1.1 Test pieces: Length 150 mm, clamping length: 100 mm, speed = (100 ± 10) mm/minute.

4.3.1.2 Test at $(+23 \pm 5)$ °C and (50 ± 6) % Relative Humidity (RH).

4.3.1.3 The test piece shall be mounted using a mandrel ($\varnothing$ = nominal inside diameter +0.5 mm) and clamping shoes on the outside.

4.3.1.4 Test is performed in longitudinal direction.

4.3.2 Strain at Break according to ISO 527-1 and ISO 527-2.

4.3.2.1 Test conditions. See paragraph 4.3.1.

4.3.2.2 Original gauge length for determining the extension is 50 mm.

4.3.3 Reference Stress according to DIN 73378.

4.3.3.1 Test at $(+23 \pm 5)$ °C.

4.3.4 Burst Pressure. 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 samples shall be assembled to ensure that the result will be a burst in the tube. The tubing is stabilized for (1 to 3) h at +23 °C. Pressure is applied at room temperature, $(+23 \pm 2)$ °C, at a rate of (7 ± 1) MPa/minute. Continue at this rate until the tubing bursts. If the tube separates from the fitting the result shall not be used.