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**SANS 1156-2:2023**

Edition 3.1

# **SOUTH AFRICAN NATIONAL STANDARD**

## **Hose for natural gas and liquefied petroleum gas (LPG)**

### **Part 2: Hose and tubing for use in natural gas and liquefied petroleum gas vapour phase**

**WARNING**

**This document references other documents normatively.**

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#### Table of changes

Change No.	Date	Scope
Amdt 1	2023	Amended to update referenced standards, the subclauses on resistance to accelerated ageing, and on the cold flex test method.

## Foreword

This South African standard was prepared by National Committee SABS/TC 1019, *Gas supply, handling and control (fuel, industrial and medical gases)*, in accordance with procedures of the South African Bureau of Standards, in compliance with annex 3 of the WTO/TBT agreement.

This document was approved for publication in March 2023.

This document supersedes SANS 1156-2:2012 (edition 3).

A vertical line in the margin shows where the text has been technically modified by amendment No. 1.

**This document is referenced in the Occupational Health and Safety Amendment Act, 1993 (Act No. 181 of 1993).**

SANS 1156 consists of the following parts:

*Hose for liquefied petroleum gas (LPG) – Part 1: Hose used in road and rail transport.*

*Hose for natural gas and liquefied petroleum gas (LPG) – Part 2: Hose and tubing for use in natural gas and liquefied petroleum gas vapour phase.*

Annex A is for information only.

**Compliance with this document cannot confer immunity from legal obligations.**

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## **Hose for natural gas and liquefied petroleum gas (LPG)**

### **Part 2:**

Hose and tubing for use in natural gas and liquefied petroleum gas vapour phase

## **1 Scope**

**1.1** This part of SANS 1156 covers flexible rubber or PVC hose and tubing for use, at a temperature from  $-10\text{ }^{\circ}\text{C}$  and not exceeding  $60\text{ }^{\circ}\text{C}$ , in LPG vapour phase and natural gas applications.

**1.2** This part of SANS 1156 also covers flexible rubber or PVC hose assemblies for natural gas.

**1.3** This part of SANS 1156 does not specify rubber hose for welding, cutting and allied processes.

NOTE 1 Rubber hose for welding, cutting and allied processes and applications, see SANS 3821.

NOTE 2 Recommendations for the safe operation of tubing and hose are given in annex A.

## **2 Normative references**

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Information on currently valid national and international standards can be obtained from the South African Bureau of Standards.

BS 5173-103.2, *Methods of test for rubber and plastics hoses and hose assemblies – Physical tests – Determination of crush resistance of hoses.*

ISO 10619-2, *Rubber and plastics hoses and tubing – Measurement of flexibility and stiffness – Part 2: Bending tests at sub-ambient temperatures.* **Amdt 1**

ISO 30013, *Rubber and plastics hoses – Methods of exposure to laboratory light sources – Determination of changes in colour, appearance and other physical properties.*

SANS 3821/ISO 3821, *Gas welding equipment – Rubber hoses for welding, cutting and allied processes.*

SANS 11431-1/ISO 1431-1, *Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 1: Static strain test.*

SANS 23529/ISO 23529, *Rubber – General procedures for preparing and conditioning test pieces for physical test methods.*

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### **3 Definitions**

For the purposes of this document, the following definitions shall apply.

#### **3.1**

##### **assembly**

length of hose or tubing supplied with a coupling or nozzle permanently attached to one or both ends

#### **3.2**

##### **coupling**

component permanently attached to a flexible hose that allows a gas tight connection to another pipework, appliances, safety, regulating or gas controlling devices

#### **3.3**

##### **hose**

flexible pipe with a smooth seamless inner lining of a rubber or thermoplastic polymer with a textile reinforcement and an outer cover of a rubber or plasticized PVC

#### **3.4**

##### **liquefied petroleum gas**

##### **LPG**

commercial butane, commercial propane, or a mixture of light hydrocarbons (predominantly propane, propene, butane and butene) that is gaseous under conditions of ambient temperatures and pressure, and that is liquefied by an increase of pressure or a lowering of temperature

#### **3.5**

##### **natural gas**

##### **NG**

hydrocarbon gas consisting mainly of methane

#### **3.6**

##### **tube**

smooth seamless unreinforced rubber or plasticized PVC flexible pipe.

### **4 Requirements for hose and tubing**

#### **4.1 General**

Only virgin material shall be used in the manufacturing process of tubes and hose for gas use.

#### **4.2 Working pressure**

**4.2.1** Tube shall be designed for use at working pressures in applications that do not exceed 5 kPa (see 4.8).

**4.2.2** Hose shall be designed for use at working pressures in applications not exceeding 1 750 kPa (see 4.8).

#### **4.3 Dimensions**

##### **4.3.1 Nominal size**

The purchaser shall specify whether tubing or hose is required and its nominal size (bore), which shall be one of the sizes given in column 1 of table 1.

### 4.3.2 Internal diameter

The internal diameter of tubing or hose, measured in accordance with 6.3, shall be within the limits given in columns 2 and 3 of table 1.

**Table 1 — Internal diameter**

1	2	3	4	5
Nominal size (bore)	Internal diameter		Liner thickness	Cover thickness
	mm		mm	
mm	min.	max.	min.	min.
6,3	5,9	6,7	1,5	1,3
8,0	7,5	8,5	1,5	1,3
10,0	9,5	10,5	1,6	1,3
12,5	12,0	13,0	1,8	1,5
16,0	15,2	16,8	2,0	1,5
20,0	19,2	20,8	2,1	1,5

### 4.3.3 Uniformity of outside diameter

When measured in accordance with 6.3, any variation in the outside diameter of tubing or hose shall not exceed 1,0 mm.

### 4.4 Adhesion between components

The adhesion between the components of the hose, determined in accordance with 6.8 shall be at least 3,0 kN/m of width.

### 4.5 Resistance to accelerated ageing

When tested in accordance with 6.4:

- a) any change in mass of a hose shall not exceed 2,5 %; and
- b) the bursting pressure of the hose shall be at least 90 % of the original value.
- c) ~~the cold flex temperature of the liner and outer cover shall be not higher than 0 °C.~~

Amdt 1

### 4.6 Colour

#### 4.6.1 Tubing

The colour of tubing shall be black.

#### 4.6.2 Hose

The colour of the cover of hose shall be orange, RGB code 255-165-0. LP gas and natural gas hose shall be marked in accordance with the requirements as given in 7.2.

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### **4.7 Strength, stretch and ageing resistance**

When tested in accordance with 6.5:

- a) tubing shall fit over the oversize nozzle shown in figure 2, shall remain attached to both nozzles throughout the period of the test, shall show no sign of splitting or cracking after ageing, and shall show no sign of leakage when subjected after ageing to an internal air pressure of 7 kPa;
- b) hose shall fit over the standard nozzle shown in figure 3, shall, after suspension under load, be free from cracks and other signs of fracture, and shall not, either before or after ageing, show any sign of leakage when subjected to an internal air pressure of 1 750 kPa; and
- c) each hose and hose assembly shall not show crack flaws or leakage.

### **4.8 Resistance to pressure**

When tested in accordance with 6.6,

- a) the increase in the outside diameter of tubing, when subjected to an internal air pressure of 200 kPa  $\pm$  15 kPa, shall not exceed 15 %, and the tubing shall show no sign of leakage; and
- b) the increase in the outside diameter of hose, when subjected to an internal air pressure of 2 600 kPa  $\pm$  50 kPa, shall not exceed 10 %, and the hose shall show no sign of leakage.

### **4.9 Resistance to burst pressure**

**4.9.1** The tubing shall not burst at a pressure of less than 350 kPa when tested in accordance with 6.7.

**4.9.2** The hose shall not burst at a pressure of less than 5 200 kPa when tested in accordance with 6.7.

### **4.10 Resistance to kinking**

The resistance to kinking of tubing or hose shall be such that, when the tubing or hose is tested in accordance with 6.9, any drop in pressure during the test does not exceed 1 kPa.

### **4.11 Resistance to cold flex**

**Amdt 1**

When hose is tested in accordance with 6.10:

- a) observe whether any cracking or breaking of the hose lining or cover occurs, and
- b) after bending, allow the test specimen to regain ambient temperature, and apply the specified proof test pressure, measure accurately to 2600 kPa  $\pm$  50 kPa to confirm whether or not any cracking or breaking of the lining or cover has occurred.

### **4.12 Resistance to crushing**

When tubing or hose is tested in accordance with 6.11, it shall show no sign of deformation or collapse.

### **4.13 Resistance to flame**

When tubing or hose is tested in accordance with 6.12 and burning results, no flame shall reach either of the outer marks.

#### **4.14 Resistance to pentane**

When tubing or the lining of hose is tested in accordance with 6.13, the pentane absorbed shall not exceed 10 % and the pentane-extractable matter shall not exceed 8 % of the initial mass of the specimen.

#### **4.15 Resistance to ozone**

When tubing or hose is tested in accordance with 6.14, it shall not split or crack.

NOTE This requirement only applies to rubber tubing or hose.

#### **4.16 Resistance to ultraviolet rays**

When tested in accordance with the requirements of ISO 30013, there shall be no cracking, change of colour or appearance of the hose or tubing.

#### **4.17 Workmanship**

The uniformity of the wall thickness of tubing and of the wall thicknesses of the lining and cover of hose shall be such that the inner and outer surfaces of the tubing and the hose are, in each case, acceptably concentric.

Tubing and hose shall be free from air holes, porosity, and other defects, and the bore shall be clean, dry, and free from foreign matter. The components of hose shall be so uniformly vulcanized together that there is no lack of adhesion between the reinforcement and the rubber of the lining and cover.

### **5 Requirements for hose assemblies**

#### **5.1 General**

Couplings used on hose assemblies shall be designed, constructed and fitted so that an assembly complies with the minimum burst pressure specified in clause 4.9 and withstands the minimum tensile force as specified in table 2. The assembly shall not show any damage or leakage.

NOTE Care should be taken to ensure that couplings are properly fitted so as not to damage the reinforcement or other vital parts of the hose.

Connections for screwed ends shall be of fire resistant and corrosion resistant material, preferably of brass, plated steel or stainless steel. Design of the connections shall be such that the assembly can be secured at one end without the necessity of turning the hose relative to its mating piece and without the use of additional fittings.

#### **5.2 Performance**

##### **5.2.1 General**

In addition to testing of hose for compliance with 4.4, 4.10 and 4.14, assemblies shall be tested for compliance with 5.2.2 to 5.2.6

##### **5.2.2 Strength, stretch and ageing resistance**

Each of the assemblies shall show no cracks, flaws or leakage when tested in accordance with 6.5.

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### 5.2.3 Resistance to burst

When tested in accordance to 6.7 the hose assembly shall not burst before sustaining a pressure of 5 200 kPa.

### 5.2.4 Flexing resistance

When subjected to conditions described in 6.13, the assembly shall withstand without leakage the un-aged test described in 6.5.1.3.1 to 6.5.1.3.3 using an internal air pressure of 2 600 kPa.

### 5.2.5 Resistance to bending

When tested in accordance with BS 5173-103.2 using a minimum radius of curvature of five times the outer diameter of the test specimen, the deformation in the outside diameter shall not be greater than 10%.

### 5.2.6 Hose and coupling integrity

When a hose assembly is tested in accordance with 6.15 but without the application of internal pressure, there shall be no movement or separation between the hose and coupling at less than the tensile force value shown in table 2 for the size of hose as appropriate.

When further tested in accordance with 6.14, there shall be no sign of leakage or other observed defect at not less than twice the working pressure specified in 4.2 for the appropriate class of hose.

**Table 2 — Minimum tensile force**

1	2	3
Internal diameter mm	Minimum tensile force	
	Tube N	Hose N
6.3	70	650
8	70	650
10	70	650
12,5	70	650
16	150	1 300
20	200	1 800

## 6 Inspection and methods of test

### 6.1 Test samples

Take a sample for testing purposes at least 10 m long from a coil. Cut test specimens shall be from the sample provided.

### 6.2 Inspection

Examine and check the sample for compliance with the relevant requirements of 4.6, and 4.17, and the requirements of 4.3 and 7.2.

## **6.3 Internal and outside diameters**

### **6.3.1 Apparatus**

**Measuring instrument**, capable of measuring accurately to 100 µm.

### **6.3.2 Test specimens**

From each of four widely separated parts of the sample cut a specimen of length approximately 15 mm, ensuring that the cuts are made perpendicular to the axis of the bore.

### **6.3.3 Procedure**

**6.3.3.1** Measure the largest internal diameter and the smallest internal diameter at one end of each specimen, record separately each of the eight values obtained for each test sample, and assess all the values so recorded for compliance with the requirements of 4.3.2; and

**6.3.3.2** Measure the largest outside diameter and the smallest outside diameter at one end of each specimen, record the difference between the highest and the lowest of all the values so obtained, and assess this for compliance with the requirements of 4.3.3.

## **6.4 Resistance to accelerated ageing**

### **6.4.1 Apparatus**

**6.4.1.1 Air oven**, that is maintained at a temperature of 100 °C ± 2 °C.

**6.4.1.2 Analytical balance**, that is accurate to 0,001 g.

### **6.4.2 Test specimens**

From each test sample cut:

- a) for the determination of change in mass: one specimen of length approximately 50 mm;
- b) for bursting pressure after ageing: two specimens as in 6.7.2; and
- c) for cold flex temperature after ageing: specimens as in 6.10.

### **6.4.3 Procedure**

**6.4.3.1** Determine the mass of the specimen taken in terms of 6.4.2(a).

**6.4.3.2** Then age all the specimens for 168 h ± 2 h in the air oven, ensuring that no specimen is in contact with another specimen or with a wall of the oven.

**6.4.3.3** Allow the specimens to cool for at least 16 h under standard test conditions, then determine:

- a) the percentage change in mass of the specimen taken in terms of 6.4.2(a);
- b) as in 6.7, the bursting pressure of the specimens taken in terms of 6.4.2(b), and record the result as a percentage of the original bursting pressure; and
- c) as in 6.10, the cold flex temperatures of the liner and of the cover.

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### 6.5 Strength, stretch and ageing resistance

#### 6.5.1 Tubing

##### 6.5.1.1 Apparatus

**6.5.1.1.1 Standard metal nozzle**, of the appropriate dimensions given in figure 1.

**6.5.1.1.2 Oversize metal nozzle**, of the appropriate dimensions given in figure 2.

**6.5.1.1.3 4,5 kg mass piece**, equipped with means for attaching it to the oversize nozzle.

**6.5.1.1.4 Pump**, capable of delivering air at a pressure of 7 kPa.

**6.5.1.1.5 Water bath**, of suitable size, and that contains water at room temperature.

**6.5.1.1.6 Oven**, maintained at a temperature of  $70\text{ °C} \pm 2\text{ °C}$ .

##### 6.5.1.2 Test specimens

From each test sample (see 6.1) cut four specimens, each of length approximately 150 mm, ensuring that the cuts are made perpendicular to the axis of the bore.

##### 6.5.1.3 Procedure

**6.5.1.3.1** Force one end of a test specimen over the standard nozzle right up to the shoulder and the other end similarly over the oversize nozzle, ensuring that the axes of the tubing and the nozzles in the assembly are aligned.

**6.5.1.3.2** Attach the standard nozzle to a hook and suspend the assembly vertically. Attach the 4,5 kg mass piece to the oversize nozzle and leave the assembly for 30 min.

**6.5.1.3.3** If the test specimen slips off either nozzle during this period, terminate the test.

**6.5.1.3.4** Otherwise, detach the assembly from the hook and also detach the 4,5 kg mass piece from the assembly. Place the assembly in the oven, age for a period of 168 h, and then examine the specimen for signs of splitting or cracking.

**6.5.1.3.5** Cool the assembly to room temperature, plug the free end of one nozzle, connect the free end of the other nozzle to the source of air pressure, immerse the assembly in the water bath, apply a test pressure of 7 kPa for 5 min, and during this period examine the specimen for signs of leakage.

**6.5.1.3.6** Repeat the test on the remaining specimens.

#### 6.5.2 Hose

##### 6.5.2.1 Apparatus

**6.5.2.1.1 Two standard metal nozzles**, of the appropriate dimensions given in figure 3).

**6.5.2.1.2 22,5 kg mass piece**, equipped with means for attaching it to a nozzle.

**6.5.2.1.3 Pump**, capable of delivering air at a pressure of  $1\ 750\text{ kPa} \pm 50\text{ kPa}$ .

**6.5.2.1.4 Water bath**, as in 6.5.1.1.5.

**6.5.2.1.5 Oven**, as in 6.5.1.1 6.

**6.5.2.1.6 Hose clips**, suitable for securing the specimen under test to the nozzles.

### **6.5.2.2 Test specimens**

Cut test specimens as in 6.5.1.2.

### **6.5.2.3 Procedure**

**6.5.2.3.1** Force each end of a test specimen over a standard nozzle, ensuring that the axes of the hose and the nozzles in the assembly are aligned.

**6.5.2.3.2** Attach one of the standard nozzles to a hook, and suspend the assembly vertically. Attach the 22,5 kg mass piece to the other nozzle, leave the assembly for 30 min, and then examine the test specimen for cracks and other signs of fracture.

**6.5.2.3.3** Detach the assembly from the hook and also detach the 22,5 kg mass piece from the assembly.

**6.5.2.3.4** Using the hose clips, secure the specimen to the nozzles, plug the free end of one nozzle, connect the free end of the other nozzle to the source of air pressure, immerse the assembly in the water bath, apply a test pressure of  $1\,750\text{ kPa} \pm 50\text{ kPa}$  for 5 min, and, during this period, examine the test specimen for signs of leakage.

**6.5.2.3.5** Place the assembly in the oven, age for a period of 72 h at  $70\text{ °C} \pm 2\text{ °C}$ , cool to room temperature, and test for leakage as in 6.5.2.3.4.

**6.5.2.3.6** Repeat the test on the remaining specimens.

## **6.6 Resistance to pressure**

### **6.6.1 Tubing**

#### **6.6.1.1 Apparatus**

**6.6.1.1.1 Water bath**, as in 6.5.1.1.5.

**6.6.1.1.2 Pump**, capable of delivering air at a pressure of  $200\text{ kPa} \pm 15\text{ kPa}$ .

**6.6.1.1.3 Callipers**.

#### **6.6.1.2 Test specimens**

From each test sample (see 6.1) cut as in 6.5.1.2, four specimens, each of length 200 mm.

#### **6.6.1.3 Procedure**

**6.6.1.3.1** By means of the callipers measure the outside diameter of a test specimen at a marked point about 100 mm from an end.

**6.6.1.3.2** Plug one end of the specimen, connect the other end to the source of air pressure, apply a test pressure of  $350\text{ kPa} \pm 15\text{ kPa}$ , and measure the outside diameter at the same point as before.

**6.6.1.3.3** Immerse the specimen in the water bath and examine for leakage.

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**6.6.1.3.4** Repeat the test on the remaining specimens.

### 6.6.1.4 Calculations

Calculate the increase in the outside diameter, OD, of each specimen as follows:

$$\text{OD \%} = \frac{(B - A)}{A} \times 100$$

where

OD is the increase in outside diameter, expressed as a percentage;

A is the initial outside diameter of tubing in millimetres;

B is the outside diameter of tubing under pressure, in millimetres;

Record as the increase in the outside diameter of each test sample the average of the four appropriate results.

## 6.6.2 Hose

### 6.6.2.1 Apparatus

**6.6.2.1.1 Water bath**, as in 6.5.1.1.5.

**6.6.2.1.2 Pump**, capable of delivering air at a pressure of 2 600 kPa ± 50 kPa.

**6.6.2.1.3 Hose clips**.

**6.6.2.1.4 Callipers**.

### 6.6.2.2 Test specimens

As in 6.6.1.2.

### 6.6.2.3 Procedure

As in 6.6.1.3, but use the hose clips to secure the ends of the specimen under test to the plug and the source of air pressure and apply a test pressure of 2 600 kPa ± 50 kPa,

### 6.6.2.4 Calculations

As in 6.6.1.4.

## 6.7 Resistance to bursting

### 6.7.1 Apparatus

**6.7.1.1 Water pump**, that is capable of applying increasing pressure at a rate of increase that can be controlled between 70 kPa/s and 180 kPa/s and up to at least 10 000 kPa.

**6.7.1.2 Two end-caps**, that are capable of sealing off the ends of the specimen under test, and one of which is fitted with a pressure gauge and means for connection to the pump, and the other with a bleed-off valve.

## **6.7.2 Test specimens**

From each test sample cut two specimens, each of length approximately 750 mm.

## **6.7.3 Procedure**

**6.7.3.1** Conduct the test at a temperature of  $23\text{ °C} \pm 2\text{ °C}$ .

**6.7.3.2** Fill a test specimen with water, fit the end-caps, and connect it to the pump ensuring that all air is expelled from the system.

**6.7.3.3** Gradually apply hydraulic pressure, until the specimen bursts.

**6.7.3.4** Repeat the test on the remaining specimen and record as the resistance to bursting of each test sample, the average of the two appropriate results.

## **6.8 Adhesion between components**

### **6.8.1 Apparatus**

**6.8.1.1 Tensile testing machine**, that is of the self-aligning type and of capacity such that the force required to separate the components under test is between 15 % and 85 % of its rated capacity. The speed of the moving beam is  $100\text{ mm/min} \pm 10\text{ mm/min}$ . The machine is equipped with an indicator that records graphically the forces applied to the test specimen during the test.

**6.8.1.2 Moving beam**, that is equipped with a jaw that can so clamp the stripped cover of the specimen as to prevent slipping during a test. The stationary beam is equipped with a mandrel (of diameter such as to ensure a close sliding fit in the bore of the test specimen) that is capable of rotating freely during the test, and that is mounted with its axis parallel to the front edges of the jaws.

**6.8.1.3 Travelling planimeter.**

### **6.8.2 Test specimens**

From each test sample cut three specimens, each of length  $25 \pm 0,5\text{ mm}$ , ensuring that each end of each specimen is perpendicular to the axis of the hose.

### **6.8.3 Procedure**

**6.8.3.1** So cut through the cover of one of the specimens, along a line parallel to the axis of the hose, as to avoid damaging the reinforcement and to separate the cover from the reinforcement for a distance sufficient to ensure adequate gripping in the moving jaw of the tensile tester.

**6.8.3.2** Fit the specimen over the fixed mandrel and clamp the stripped end of the cover in the moving jaw.

**6.8.3.3** Operate the machine for the maximum distance possible.

**6.8.3.4** Repeat the test on the remaining specimens.

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### 6.8.4 Calculation

By means of the planimeter, determine, from the graphical records produced, the average force required to separate the cover of each specimen. Calculate the adhesion between the liner and cover of each specimen as follows:

$$AD = \frac{X}{25}$$

where

X average force,  $\frac{N}{25}$

AD is adhesion, expressed in kN/m of width.

Record as the adhesion of the test sample, the average of the three results.

## 6.9 Resistance to kinking

### 6.9.1 Apparatus

**6.9.1.1 Supply of inert gas**, maintained at a pressure of 2,8 kPa.

**6.9.1.2 Two end-caps**, that are capable of sealing off the ends of the specimen under test, and one of which is fitted with means for connection to the gas supply, and the other with the pressure gauge and the gas jet.

**6.9.1.3 Equipment**, that regulates the flow of gas at a rate of 0,2 m<sup>3</sup>/h.

**6.9.1.4 Pressure gauge**, that is calibrated in kilopascals.

**6.9.1.5 Steel rule**, that is calibrated in millimetres.

### 6.9. Test specimens

From each test sample (see 6.1) cut two specimens, each of length approximately 750 mm.

### 6.9.3 Procedure

**6.9.3.1** Fit the end-caps to the ends of a test specimen and connect the specimen to the gas supply.

**6.9.3.2** With the gas flowing through the jet, adjust the pressure (as registered on the pressure gauge) to 2,8 kPa, and place the specimen flat on a bench next to the rule.

**6.9.3.3** Take in the fingers two points on the specimen that are spaced at the appropriate interval (see table 3), bring them together so that the specimen takes the form of a loop (see figure 4), hold the specimen in this position for 30 s, and record any drop in pressure registered on the pressure gauge.

**Table 3 — Spacing intervals**

1	2
Nominal size mm	Spacing mm
Up to and including 8	280
10	350
12,5	440
16,0	560
20,0	700

**6.9.3.4** Test the remaining specimens in the same way.

## **6.10 Cold flex test**

**Amdt 1**

When tested in accordance with ISO 10619-2, method B, at  $(-10 \pm 2)$  °C, using a diameter of curvature of ten times the internal diameter (with a minimum of 80 mm), the hose shall show no sign of leaks when subjected to the proof pressure of 2 600 kPa carried out at ambient temperature. Check for compliance with the requirements in 4.11.

**Amdt 1**

## **6.11 Resistance to crushing**

### **6.11.1 Apparatus**

**Self-aligning-type apparatus**, of size and design to apply a uniform compressive force of at least 350 N over a length of 25 mm of a specimen under test, and equipped with an indicator that records, in newtons, the applied force.

### **6.11.2 Test specimens**

From each test sample (see 6.1) cut two specimens, each of length approximately 200 mm.

### **6.11.3 Procedure**

**6.11.3.1** Place a specimen in the apparatus and apply, for 30 s, a force of 125 N in the case of tubing, and 340 N in the case of hose. Release the force and examine the specimen for signs of deformation or collapse (or both).

**6.11.3.2** Test the remaining specimens in the same way.

## **6.12 Resistance to flame**

### **6.12.1 Apparatus**

**6.12.1.1 Well-aerated bunsen burner**, that produces a flame of diameter approximately 25 mm and that generates heat at a rate of about 1 800 kJ/h.

**6.12.1.2 Stop-watch.**

### **6.12.2 Test specimens**

From each test sample (see 6.1) cut two specimens each of length approximately 200 mm.

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### 6.12.3 Procedure

**6.12.3.1** Make three marks on a test specimen, one approximately midway along the specimen, and one on each side of, and 50 mm from, the central mark. Support the ends of the specimen that the marks are in approximately the same horizontal plane (see figure 5).

**6.12.3.2** Direct the flame from the burner on to the specimen that the flame is vertical, in the same plane as the marks, perpendicular to the axis of the specimen, and centred on the central mark (see figure 5).

**6.12.3.3** Simultaneously start the stopwatch. Apply the flame for 5 s and then remove it for 1 s. Repeat the application and removal of the flame until the specimen catches fire and continues to burn or until a total test period of 45 s has elapsed.

**6.12.3.4** If the specimen catches fire and continues to burn without further application of the flame, note whether or not the flame reaches either of the outer marks within 45 s of the first application of the flame.

**6.12.3.5** Test the remaining specimen in the same way.

### 6.13 Resistance to pentane

#### 6.13.1 Apparatus

**Glass container**, of capacity 500 cm<sup>3</sup> and equipped with a loosely-fitting stopper.

#### 6.13.2 Test liquid

N-pentane of analytical grade.

#### 6.13.3 Test specimens

From each test sample cut 3 test pieces at random over the coil. The test specimen shall be of a mass of approximately 5 g, taking it, in the case of hose, from the lining of the hose after preparing the test sample in accordance with SANS 23529.

#### 6.13.4 Procedure

**6.13.4.1** Determine (to the nearest milligram) the mass of the specimen.

**6.13.4.2** Add to the glass container a volume of the test liquid equal to at least 50 times the volume of the specimen.

**6.13.4.3** Immerse the specimen in the test liquid for 168 h at 23 °C ± 2 °C temperature, then remove the specimen from the test liquid, condition it for 5 min in air at 23 °C ± 2 °C temperature, and redetermine its mass.

**6.13.4.4** After further conditioning for 24 h under the same conditions, redetermine its mass.

#### 6.13.5 Calculations

Calculate the pentane absorbed  $P_{ab}$ , and the pentane-extractable,  $P_{ex}$ , matter, as follows:

$$a) \quad P_{ab} = \frac{(m_1 - m_2)}{m_0} \times 100$$

$$b) \quad P_{ex} = \frac{(m_0 - m_2)}{m_0} \times 100$$

where

$P_{ab}$  is pentane absorbed, expressed as a percentage.

$P_{ex}$  is pentane extractable, expressed as a percentage.

$m_0$  is the initial mass, in grams

$m_1$  is the mass after immersion and conditioning for 5 min, in grams.

$m_2$  is the mass after conditioning for 24 h, in grams.

## **6.14 Resistance to ozone**

### **6.14.1 Apparatus**

**6.14.1.1 Ozone chamber**, an exposure chamber supplied from an ozone generator, as described in SANS 11431-1.

**6.14.1.2 Standard nozzle**, of the appropriate shape and dimensions (see figures 1 and 3).

### **6.14.2 Test specimens**

From the sample provided cut a specimen of length approximately 150 mm.

### **6.14.3 Procedure**

**6.14.3.1** Push the specimen on to the standard nozzle until it is in contact with the collar of the nozzle and place the assembly in the ozone chamber for 72 h.

**6.14.3.2** After removal of the specimen from the chamber, examine it for signs of splits or cracks (or both). Ensure that no cracks are visible when the sample is viewed under at least two times magnification.

## **6.15 Hose assembly integrity**

**6.15.1** Following ageing in accordance with 6.4.3, secure one end of the hose assembly and apply longitudinal tensile force to the other end. Refer to table 2 for minimum tensile forces applied. Apply the force at a rate of elongation ( $75 \pm 5$ ) mm per min and hold the final force for 30 s at ambient temperature.

**6.15.2** Following this test, inspect the hose assembly for rupture and for movement of the end fittings relative to the hose. If there is no rupture or movement, test the hose assembly for compliance with the requirements of 4.8, and ensure that there is no leak between the hose and end fittings.

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### **7 Packing and marking**

#### **7.1 Packing**

Each length of tubing and hose shall be supplied in an individual coil. Each coil shall be firmly tied and so protected as to prevent contamination of the bore and damage during normal transportation.

Each hose assembly shall be protected in order to prevent contamination of the bore and damage of the coupling during normal transportation or storage.

#### **7.2 Marking**

##### **7.2.1 Tubing and hose**

Each length of tubing and hose shall bear, at intervals not exceeding 1 m, the following information in legible and durable marking:

- a) the manufacturer's name or trade mark or both;
- b) the nominal size;
- c) the standard number (SANS 1156-2);
- d) the month and year of manufacture; and
- e) the letters "LPG/NG".

##### **7.2.2 Coils**

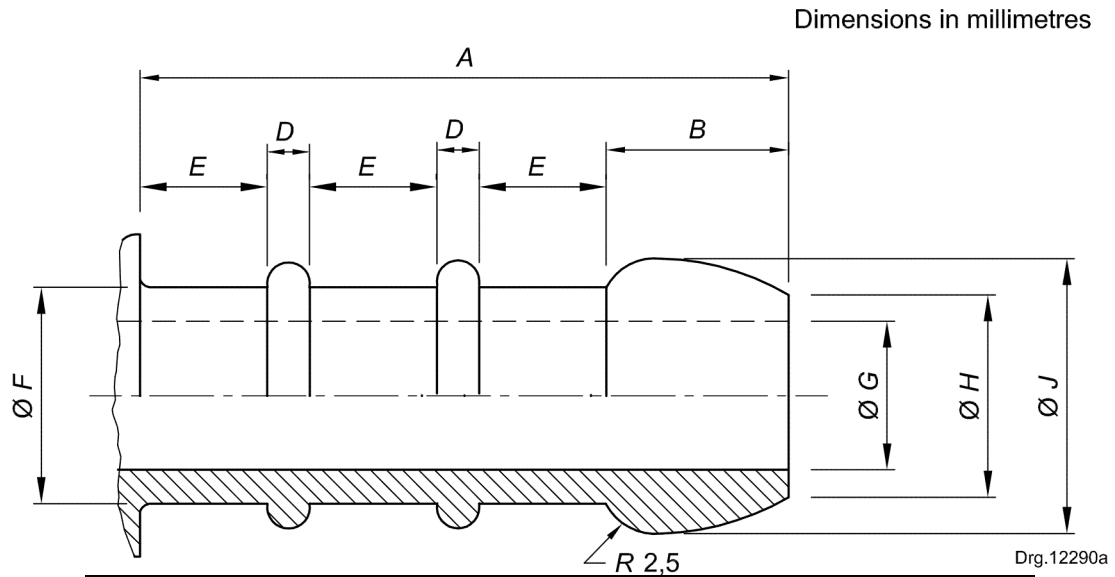
The following information shall be given, in legible and indelible marking, on a label securely attached to each coil:

- a) the information required in terms of 7.2.1; and
- b) the length of tubing or hose in the coil, in metres.

##### **7.2.3 Hose assemblies**

A metallic element, being part of the coupling of the assembly, shall be permanently marked with the name of the manufacturer of the assembly or his identification, and either a date or batch code.

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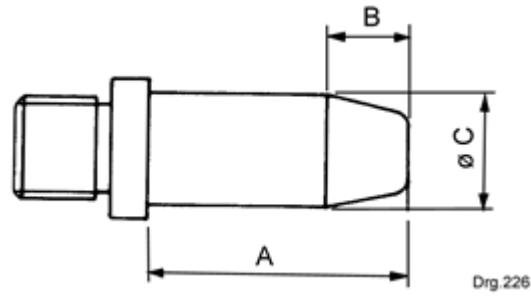


1	2	3	4	5	6	7	8	9	10
Nominal bore	Dimension <sup>a</sup>								
	A	B	C	D	E	Diam. F	Diam. G	Diam. H	Diam. J
5	25	8,5	6,5	1,5	4,5	5	3	4	7
6,3	25	8,5	6,5	1,5	4,5	6,3	4	5	8
8	25	8,5	6,5	1,5	4,5	8	5	6,3	10
10	38	16	12	2	6	10	7	8	12
12,5	38	16	12	2	6	2,5	8,5	9,5	14,5

<sup>a</sup> Subject, in all cases, to a tolerance of  $\pm 0,125$  mm.

**Figure 1 — Standard metal nozzle for tubing**

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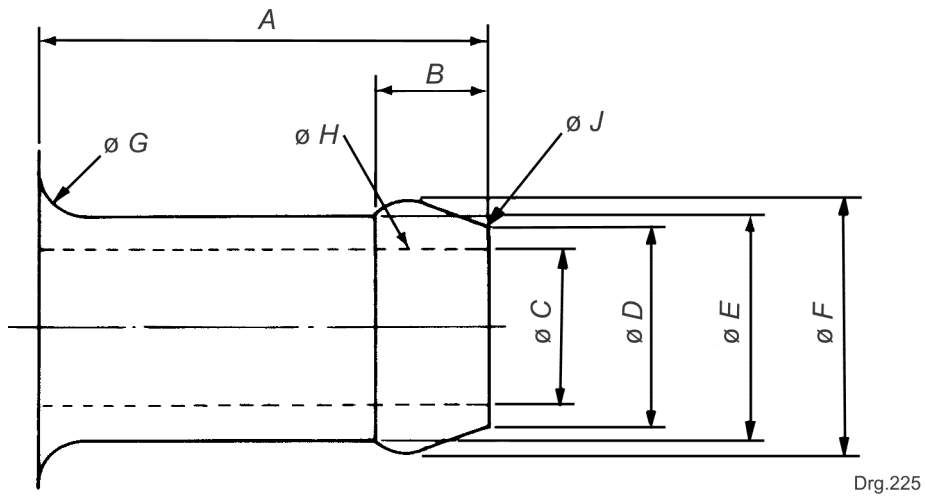


Dimensions in millimetres

Nominal bore	Dimensions <sup>a</sup>		
	A	B	Diam. C
1	2	3	4
5	30	10	10
6,3	30	10	12,5
8	30	10	16
10	40	10	20
12,5	40	10	25

<sup>a</sup> Subject, in all cases, to a tolerance of  $\pm 0,125$  mm.

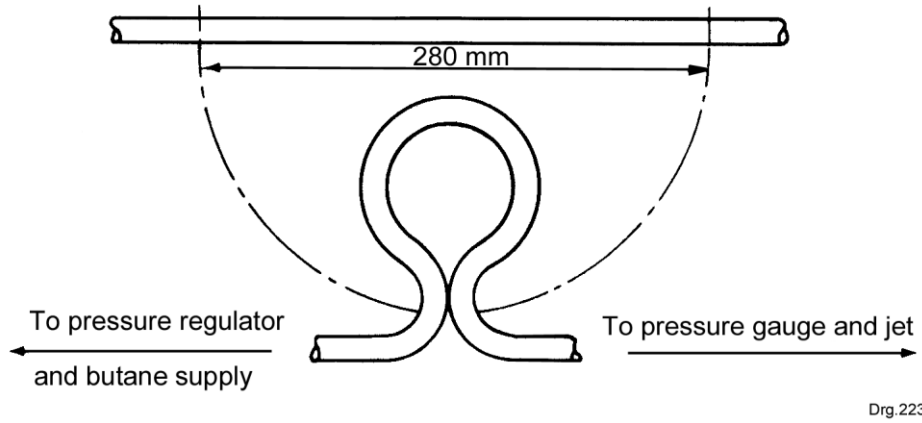
**Figure 2 — Oversize metal nozzle for tubing**



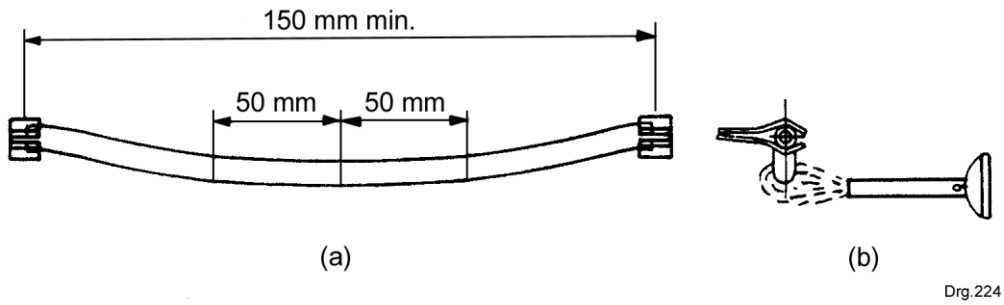
Dimensions in millimetres

Nominal bore	Dimension								
	A	B	Diam. C	Diam. D	Diam. E	Diam. F	Diam. G	Diam. H	Diam. J
1	2	3	4	5	6	7	8	9	10
5	25,0	6,4	3,2	4,5	5,0	5,94	1,0	1,0	0,4
6,3	25,0	8,0	4,8	6,2	6,3	7,95	1,3	1,3	0,4
8	25,0	8,7	6,3	6,9	8,0	9,04	1,5	1,5	0,4
10	38,0	8,7	7,9	8,6	9,5	11,10	2,0	2,0	0,4
12,5	38,0	12,0	8,7	11,6	12,5	14,30	2,5	2,5	0,4

**Figure 3 — Standard metal nozzle for hose**



**Figure 4 — Diagram illustrating kinking test**



**Figure 5 — Diagram illustrating flame resistance test**

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### Annex A

(informative)

#### Safe operation of tubing and hose

The following requirements are intended to assist generally in the safe operation of tubing and hose complying with the requirements of this standard, and are particularly intended to provide guidance to appliance manufacturers:

- a) clips, clamps, or spigots used to retain the hose on fittings should be free from burrs and rough edges and must not be over-tightened,
- b) tubing or hose should not be allowed to come into direct contact with parts of an appliance that become hot during use,
- c) tubing or hose should not be used in a situation where the ambient temperature may be higher than 60 °C, and
- d) appliance manufacturers shall (as a minimum) provide instructions for the safe use/installation of tubing/hoses including inspection and maintenance requirements.

#### Bibliography

SANS 54/ISO 188, *Rubber, vulcanized or thermoplastic – Accelerated ageing and heat resistance tests.*

| SANS 1086, *Flexible poly(vinyl chloride) (PVC) pressure hose.*

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SANS 1774, *Liquefied petroleum gases.*

SANS 11431-3/ISO 1431-3, *Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 3: Reference and alternative methods for determining the ozone concentration in laboratory test chambers.*