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Saudi Standards, Metrology and Quality Org. (SASO)



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METHODS OF TESTING
RUBBER HOSES FOR HOUSEHOLD APPLIANCES USING LIQUEFIED
PETROLEUM GASES

ICS : 83.140

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METHODS OF TESTING RUBBER HOSES FOR HOUSEHOLD APPLIANCES USING LIQUEFIED PETROLEUM GASES

1- SCOPE AND FIELD OF APPLICATION

This standard is concerned with the methods of testing low pressure rubber hoses for household appliances using liquefied petroleum gases.

2- COMPLEMENTARY REFERENCES

- 2.1 SASO 166 “Rubber Hoses for Household Appliances Using Liquefied Petroleum Gases”.

3- VISUAL INSPECTION

The hose shall be visually inspected with the naked eye to check any visual defect in manufacture. Information marked on the hose shall also be checked.

4- MEASUREMENT OF INTERNAL DIAMETER

4.1 Specimen

A specimen for measuring internal diameter shall be taken at a distance not less than 25 mm from one of the hose ends and in such a way that the cross-section is straight and vertical to the hose axis.

4.2 Apparatus

- 4.2.1 Apparatus for measuring internal diameters with an accuracy of at least 0.05 mm.

4.3 Procedure

- 4.3.1 Take two measurements of internal diameters at right angles to each other in one plane using the measuring apparatus.

4.4 Result

Calculate the mean value of the two readings and consider it the internal diameter of the hose.

5- HYDRAULIC PRESSURE TESTS

5.1 Specimen

Three specimens, each one metre long, shall be taken from one hose from each group.

5.2 Apparatus

5.2.1 Hydraulic pump capable of applying suitable pressure, variable at a uniform rate.

5.2.2 A calibrated test pressure gauge.

5.3 Procedure

5.3.1 Proof pressure test

5.3.1.1 Connect one specimen to the hydraulic liquid supply (water), air being expelled through a valve in the free end, then this valve shall be closed and an initial pressure of 0.05 MPa applied for one minute.

5.3.1.2 Increase the pressure at a rate of 0.075-0.150 MPa/s to the required proof pressure.

5.3.1.3 The specimen shall be maintained at this pressure for one minute and any leakage or irregular expansion in the hose shall be noted.

5.3.2 Burst pressure test

5.3.2.1 The other specimen shall be connected to the water supply.

5.3.2.2 The pressure shall be increased at the same rate and way as in 5.3.1 until the specified minimum bursting pressure is attained or the hose bursts.

5.3.3 Dimensional stability test

5.3.3.1 Three reference marks A, B and C as circumferential arcs shall be made on the outer surface of the third specimen of the hose, the middle mark B shall be midway along the length of the hose and the two outer marks A & C each 250 mm apart from B. The circumference shall then be measured at these three points after applying the initial pressure (5.3.1.1).

5.3.3.2 The proof pressure shall be applied according to the same steps and rate as in 5.3.1. The distance between A and B and between B and C as well as the circumference at A, B and C shall be measured again to the nearest mm after applying the proof pressure.

5.4 Result

Changes in dimensions shall be calculated as follows:

5.4.1
$$\% \text{ change in length} = \frac{L_1 - L}{L} \times 100$$

Where:

L = length at initial pressure.

L₁ = length at final pressure (proof pressure).

$$5.4.2 \quad \% \text{ change in diameter} = \frac{\sum C_1 - \sum C}{\sum C} \times 100$$

Where:

$\sum C$ = The sum of the three circumferences at A, B and C measured at the initial pressure.

$\sum C_1$ = The sum of the three circumferences at A, B and C at the final pressure (proof pressure).

5.5 Report

The report shall include the following:

- 5.5.1 Occurrence of any cracks, leakage, or defects because of applying the proof pressure.
- 5.5.2 Whether or not bursting occurs and the value of pressure at which bursting occurs.
- 5.5.3 Ratios of change in diameter and length because of applying the proof pressure.

6- SWELLING TEST

6.1 Specimen

A piece of hose 20-50 mm long and maximum (2 ± 0.1) mm thick shall be taken. Remove cloth or fibers (if any), without using solvents.

6.2 Procedure

- 6.2.1 Determine the original volume of the specimen (V_1), by weighing it in the air and then in distilled water, then dry it with a stream of dry air at $(23 \pm 2)^\circ\text{C}$.
- 6.2.2 Keep the specimen at $(23 \pm 2)^\circ\text{C}$ for at least 3 hours directly before carrying out the test.
- 6.2.3 Immerse the test specimen in liquid pentane for 72 hours at $(23 \pm 2)^\circ\text{C}$.
- 6.2.4 Remove the specimen, dry it in air from liquid pentane and leave for 5 minutes.
- 6.2.5 The volume of the specimen after swelling test (V_2) is then determined by weighing it in air and then in distilled water.

6.3 Result

$$\text{Percentage of swelling} = \frac{V_2 - V_1}{V_1} \times 100$$

Where:

V_1 = The original volume of specimen.

V_2 = The volume of specimen after swelling test.

7- AGEING TEST

7.1 Specimens

Two specimens of not less than 500 mm long shall be taken from one hose from each group.

7.2 Apparatus

A thermostatically controlled air oven providing the required temperature range.

7.3 Procedure

7.3.1 Place the specimens in the oven at $(70 \pm 2)^\circ\text{C}$ for 7 days $\pm$ 2 hours, each sample shall be placed in the oven so as to be exposed to air from all sides (while renewing the oven air continually at a slow rate) but not exposed to light or any stresses.

7.3.2 Remove specimen from the oven after the specified period and maintain at $(23 \pm 2)^\circ\text{C}$ and $(65 \pm 10)\%$ relative humidity for 24 hours.

7.3.3 The burst pressure test shall be carried out after ageing on one of the two specimens according to 5.3.2.

7.4 Result

Calculate the percentage of change in burst pressure (ΔP_b) of the specimen because of ageing test.

$$\Delta P_b = \frac{P_2 - P_1}{P_1}$$

Where:

P_1 = Burst pressure before aging test (obtained from 5.3.2)

P_2 = Burst pressure After aging test (obtained from 7.3)

7.5 Report

The report shall include the following:

7.5.1 Temperature at which ageing is carried out.

7.5.2 Time of ageing.

7.5.3 The percentage of change in burst pressure.

8- FLAME RESISTANCE TEST

8.1 Specimen

Six specimens, each 300 mm long, shall be taken from one hose from each

group.

8.2

Apparatus

The apparatus shall consist of the following:

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- 8.2.1 A shield made from fire resistant material with dark interior and its dimensions are as follows: 660 in width by 610 in depth by 1065 mm in height with a 150 mm diameter hole at the top (to allow fumes to escape). It is equipped with a hand hole or flap at one side and the front is provided with a viewing panel.
- 8.2.2 A stand for supporting the specimen.
- 8.2.3 Ignition source as shown in Fig. (1).
- 8.2.4 Stopwatch.
- 8.3 Procedure
 - 8.3.1 Specimens shall be kept at $(23 \pm 2)^{\circ}\text{C}$ and $(65 \pm 10)\%$ relative humidity for 4 hours at least before testing.
 - 8.3.2 Adjust the position of the burner so as to have its base at an angle of 45° to the horizontal, its top 50 mm far from the specimen and the flame impinges on the centre of the specimen at an angle of 90° to the longitudinal axis as shown in Fig. (2).
 - 8.3.3 Allow the flame to impinge on the specimen for 60 seconds, observe any flame or glowing in the specimen, determine the duration of time of flame or glowing.
 - 8.3.4 Repeat the same test with remaining specimens.
- 8.4 Result
 - 8.4.1 Calculate the average time (for the six specimens) after which the flame, glowing or both occur to specimens.
 - 8.4.2 Calculate the mean duration of flame or glowing.

9- ADHESION TEST

- 9.1 Definition

The force required to separate a rubber layer from a fabric ply bonded with it.
- 9.2 Procedure
 - 9.2.1 A minimum of two test pieces, the length of each is (25 ± 0.5) mm, shall be selected.
 - 9.2.2 The test pieces shall be conditioned for a minimum of 24 h in a standard atmosphere of $(23 \pm 2)^{\circ}\text{C}$ and $(50 \pm 5)\%$ relative humidity before testing.
 - 9.2.3 Separate the ply of fabric or the rubber layer by hand for approximately 50 mm. Fix the separate end in the grip and fit the body of the test piece over the mandrel fitted in place of the other grip. The angle of separation shall be approximately 90° .

- 9.2.4 Adjust so that the tension is distributed uniformly and that no twisting of the test piece occurs during the test.
- 9.2.5 The rate of travel of the power-driven grip shall be 100 mm/min.
- 9.2.6 Continue the ply separation and record the force over a length of separation of at least 100 mm.
- 9.3 Result
 - The force required for separation shall be not less than 35 Newtons.

10- STRENGTH AND STRETCH TEST

- 10.1 Four specimens of hoses, each at least 150 mm, shall be selected.
- 10.2 Suspend each test piece vertically with a mass of 22.5 kg attached to its lower end and leave the assembly to stand for 30 min.
- 10.3 Examine the test pieces and reject those which show signs of fractures or cracks.
- 10.4 Immerse the pieces which were not rejected according to item 10.2 in water for 5 min with an internal air pressure of 17.5 bar.
- 10.5 Examine the remaining pieces and reject those test pieces which show signs of leakage.
- 10.6 Place the test pieces which were not rejected according to items 10.2 and 10.4 in an ageing oven for 168 h at 70°C, then cool to room temperature.
- 10.7 Immerse them in water and repeat the procedure in 10.4.
- 10.8 Reexamine the test pieces for leakage.
- 10.9 The hose shall show no fracture, cracks, or leakage.

11- RESISTANCE TO KINKING TEST

- 11.1 Sample
 - Take one piece of hose about 0.6 m and lay it horizontally on the bench.
- 11.2 Apparatus
 - 11.2.1 A supply of butane gas, connect it to one end of the selected hose piece.
 - 11.2.2 A water manometer calibrated in milli bars, connect it to the other end of the hose piece.
 - 11.2.3 A jet which will permit a flow of gas of 0.225 m³/h at 26 milli bars pressure.
 - 11.2.4 A ruler marked in millimeters, horizontally placed on the bench alongside the hose under test.

11.3 Procedure

- 11.3.1 Adjust the pressure of gas to read 26 mbar on the manometer with the gas flowing through the orifice of the hose.
- 11.3.2 Take in the fingers two points on the hose spacing 280 mm by using the ruler.
- 11.3.3 Bring the two points together so that the hose takes the form of a loop (Figure 3). Hold the loop for 30 s with the gas flowing through.
- 11.3.4 Record any pressure drop shown on the manometer (during this period).

11.4 Result

The drop in gas pressure shown on the manometer shall not be less than 10 mbar.

12- RESISTANCE TO CRUSHING TEST

- 12.1 A hose specimen 25 mm long shall be subjected to a crushing force of 340 N applied evenly over its length for 30 s. After removal of the force the specimen shall show no deformation or collapse, nor shall it leak when subjected to an internal air pressure of 0.75 bar.
- 12.2 The hose shall be connected to a supply of butane maintained at a constant pressure of 27.5 mbar at the inlet to the hose. A variable control shall be fitted at the outlet end and adjusted to give a gas rate of 0.28 m³/h. A crushing force of 340 N shall then be applied evenly over a length of 25 mm of the hose specimen for 30 s.
- 12.3 The gas flow rate shall not be less than 0.07 m³/h.

13- RESISTANCE TO OZONE TEST

- 13.1 Select a hose specimen 150 mm long.
- 13.2 One of the sample ends shall be pushed up to the collar of the appropriate nozzle.
- 13.3 The assembly shall be placed in an ozone cabinet for 72 h at room temperature. The ozone concentration shall be maintained constant.
- 13.4 The hose specimen shall not split or crack.

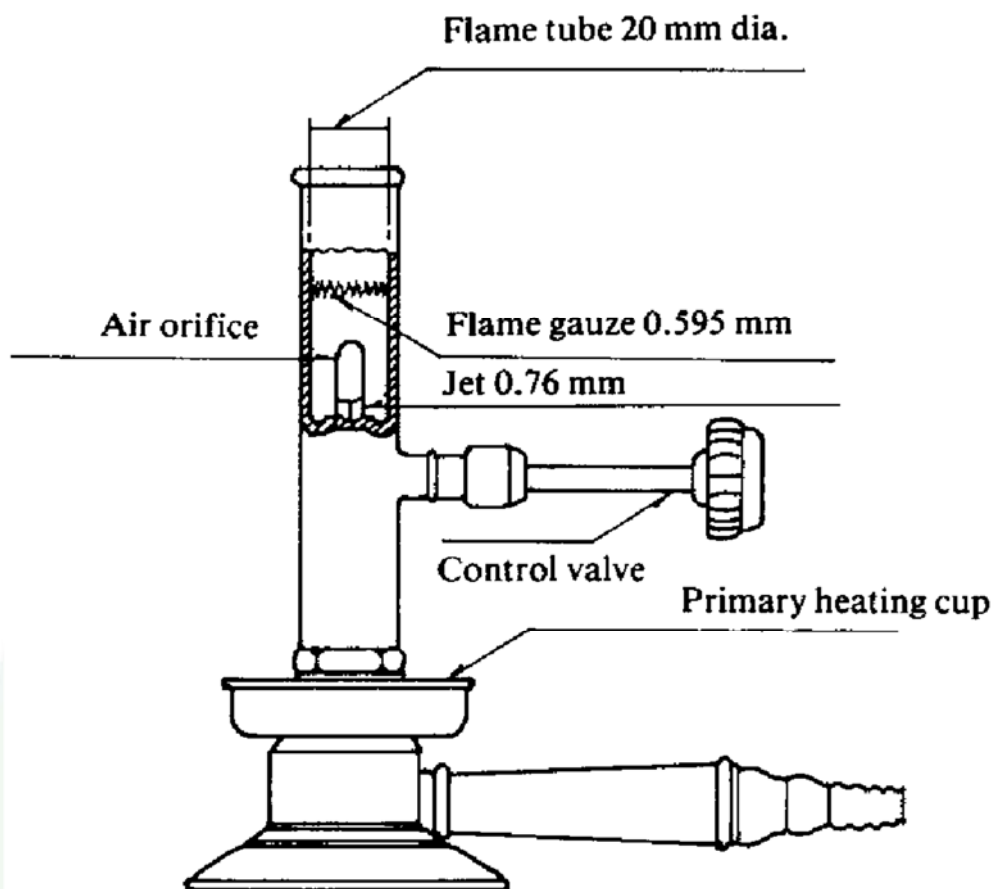


Fig. 1
Burner for flame resistance test

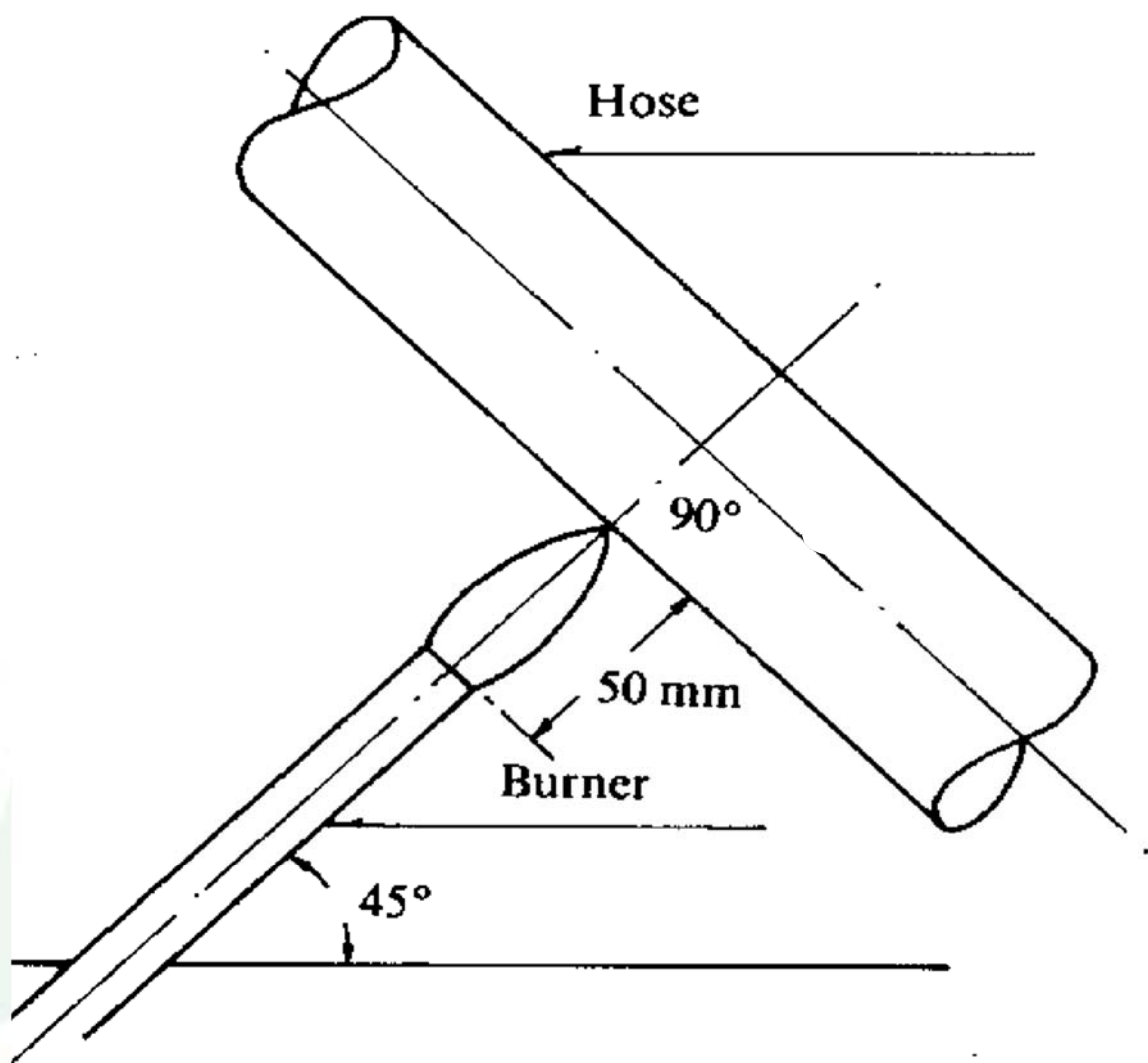
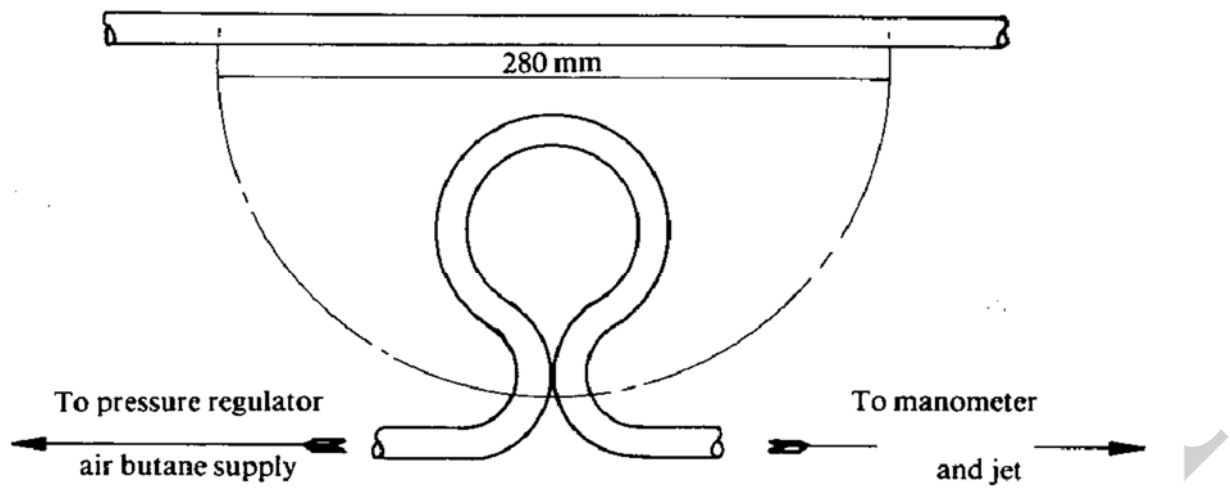


Fig. 2

Position of burner flame test specimen



Not to scale.

Fig. 3
Diagram illustrating kinking test