INTERNATIONAL STANDARD

ISO 8308

Second edition
1993-04-01

Rubber and plastics hoses and tubing — Determination of transmission of liquids through hose and tubing walls

Tuyaux et tubes en caoutchouc et en plastique — Détermination de la transmission des liquides à travers les parois des tuyaux et des tubes

Reference number
ISO 8308:1993(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 8308 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Sub-Committee SC 1, *Hoses (rubber and plastics)*.

This second edition cancels and replaces the first edition (ISO 8308:1987), of which it constitutes a technical revision.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland
Printed in Switzerland

Rubber and plastics hoses and tubing — Determination of transmission of liquids through hose and tubing walls

1 Scope

This International Standard specifies two methods for the determination of transmission of liquids through hose and tubing walls. Both methods are applicable to rubber and plastics hose and tubing, and comprise:

Method A — for all hose sizes and constructions: a practical comparative test, simulating working conditions.

Method B — for hose and tubing up to 16 mm internal diameter.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 471:1983, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 4671:1984, *Rubber and plastics hose and hose assemblies — Methods of measurement of dimensions.*

ISO 4788:1980, *Laboratory glassware — Graduated measuring cylinders.*

3 Principle

3.1 Method A

This method is carried out on an assembly mounted in a test apparatus fitted with equipment to fill and measure a charged volume of a volatile liquid. The system is put under pressure, and the change in volume measured at 24-h intervals until the change has become constant with time, i.e. an equilibrium state has been reached. The test result is this steady-state evaporation rate, expressed as the volume of liquid lost per hour per unit inside surface area of the hose or tubing.

3.2 Method B

This method uses a pressureless reservoir. A length of hose or tubing is attached to the reservoir, the other end of the hose or tubing being plugged. The reservoir is partially filled with test liquid and sealed. The assembly is weighed at the start of the test, and once every 24 h for eight days. The test result is the maximum mass of liquid lost in any one 24-h period per unit inside surface area of the hose or tubing.

NOTE 1 The method accounts for loss by permeation and evaporation and helps to minimize selective permeation of components in a fuel mixture since the liquid is agitated daily.

4 Test liquid

The test liquid shall be that specified in the appropriate product standard.

5 Method A

WARNING — Because of the presence of potentially hazardous vapours, ensure that this test is carried out in a well ventilated area.

5.1 Apparatus

The apparatus consists of a nitrogen gas source connected to a pipe system. The gas pressure is controlled by a regulator and pressure gauge.

It is essential that the system be provided with a safety valve.

The test piece is fixed vertically and is connected to the apparatus at the top via a measuring cylinder conforming to ISO 4788 and at the bottom via a charging pipe (see figure 1).

5.2 Test pieces

Each test piece shall be either a hose assembly with a free hose length of 250 mm, or a sample of tubing, in accordance with figure 2, fitted with suitable couplings and adapters.

Three test pieces shall be tested.

5.3 Test temperature

The test temperature shall be one of the standard temperatures defined in ISO 471.

5.4 Test pressure

The test pressure shall be 50 kPa ± 5 kPa (0,5 bar ± 0,05 bar) above atmospheric pressure.

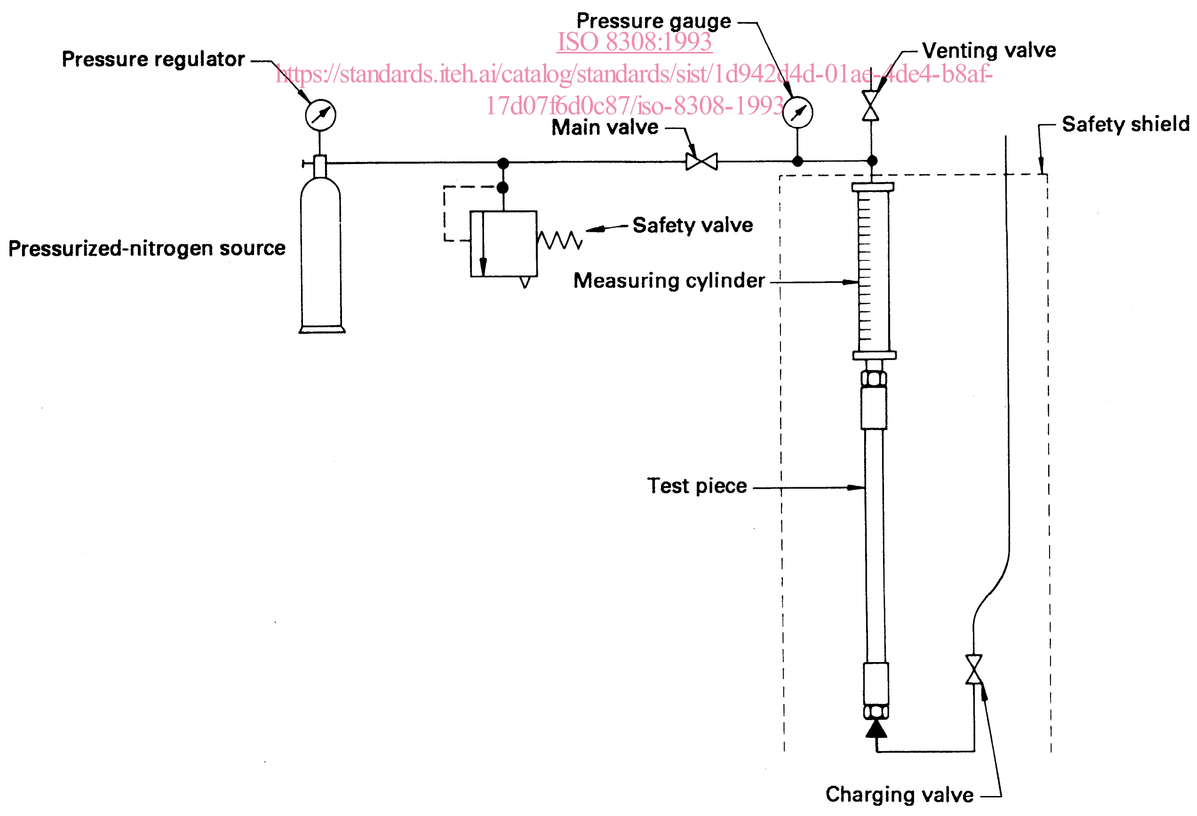

Figure 1 — Apparatus for method A

Dimensions in millimetres

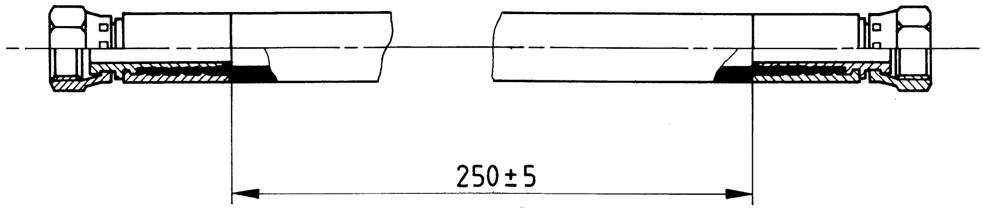

Figure 2 — Internal free length, with tolerance, of test piece

5.5 Procedure

5.5.1 Determine the internal free length l, as indicated in figure 2, and the internal diameter d, as specified in ISO 4671.

5.5.2 Connect the test piece to the test apparatus (see figure 1).

5.5.3 Fill the test piece and the measuring cylinder with test liquid up to the top graduation mark of the measuring cylinder.

5.5.4 Taking the dilation of the hose or tubing at the test pressure into account, maintain the test piece at the test pressure for 5 min. Release the nitrogen pressure and allow the dissolved gas to escape over a period of 5 min, then record the initial reading V_i shown by the measuring cylinder.

5.5.5 Apply the test pressure.

5.5.6 Take measurements after 24 h, 48 h, 72 h and 96 h, using the following method:

Close the main valve, then release the test pressure and wait 5 min before recording the new reading V_t. Close the venting valve, and open the main valve to re-apply the test pressure.

If the volume loss after 96 h, calculated in accordance with 5.6, does not appear to have stabilized, take another measurement after 120 h (and another after 144 h if necessary).

5.6 Expression of results

5.6.1 Calculate the loss in volume for each 24-h interval between measurements, and determine the point at which the loss becomes constant. Beyond this point, diffusion of the liquid into the hose or tubing wall no longer contributes to the loss in volume, and the loss observed thus represents evaporation only.

5.6.2 If the steady state is reached before 72 h, calculate the evaporation rate, in cubic centimetres per square metre per hour, using the formula

$$\frac{(V_{72} - V_{96}) \times 10^6}{\pi \times d \times l \times 24}$$

where

- V_{72} is the volume, in cubic centimetres, after 72 h;
- V_{96} is the volume, in cubic centimetres, after 96 h;
- d is the internal diameter, in millimetres, of the hose or tubing;
- l is the internal free length, in millimetres, of the hose or tubing.

In cases where further measurements have been made after periods longer than 96 h, replace V_{72} and V_{96} in the above formula by the corresponding penultimate and final volume measurements.

5.7 Test report

The test report shall include the following information:

a) a full description of the hose or tubing tested;

b) a reference to this International Standard;

c) the test method (method A);

d) the test liquid;

e) the steady-state evaporation rate, expressed as cubic centimetres lost per square metre per hour;

f) the test temperature used;

g) the date of the test.

6 Method B

6.1 Apparatus

6.1.1 Reservoir unit, consisting of a half-litre can, with a metal-foil or fluorelastomer-lined screw-on cap, and with a standard hose nipple soldered into the bottom of the can at the corner opposite the filling hole (see figure 3).

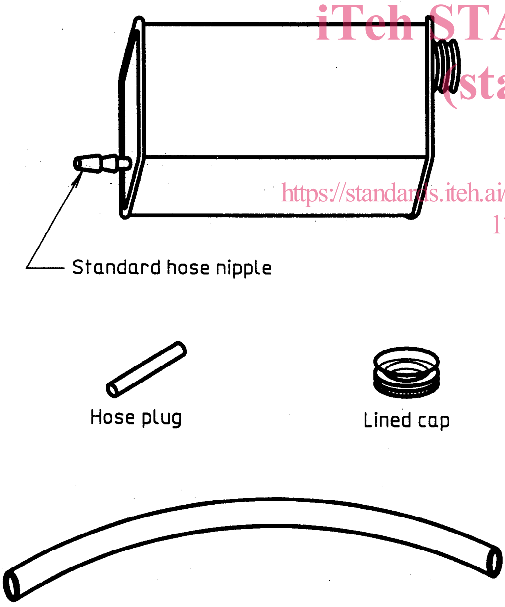

Figure 3 — Apparatus for method B

6.1.2 Scales or **balance**, with a minimum capacity of 400 g and readable to 0,01 g.

6.1.3 Impermeable hose plug, of sufficient size to seal one end of the hose or tubing to a depth of 12,5 mm.

6.1.4 Standard hose clamps, of the correct size for the hose or tubing being tested.

6.2 Test piece

Cut hose and tubing to 300 mm length.

6.3 Test temperature

The test temperature shall be one of the standard temperatures defined in ISO 471.

6.4 Procedure

6.4.1 Gauge the hose or tubing bore and record the result in millimetres.

6.4.2 Plug one end of the test piece to a depth of 12,5 mm using an impermeable plug (6.1.3), as well as a hose clamp (6.1.4) if necessary.

6.4.3 Attach the other end of the test piece to the nipple on the reservoir (6.1.1) to a depth of 12,5 mm, using a hose clamp (6.1.4) if necessary.

6.4.4 Fill the reservoir with 300 ml of the specified test liquid.

6.4.5 Seal the reservoir with the screw cap (see 6.1.1).

6.4.6 Weigh the reservoir/test piece assembly to the nearest 0,01 g and record the result.

6.4.7 To ensure complete filling of the hose, orient the assembly vertically and gently tap the hose to eliminate any air trapped in the hose (see figure 4).

6.4.8 Place the assembly horizontally in its storage position with the reservoir resting on the narrow side nearest the nipple, and with the hose in a horizontal position (see figure 5). The storage location shall be temperature-controlled to standard temperature (see 6.3), with free-flowing air to prevent fume build-up.

6.4.9 Weigh the assembly every 24 h ± 0,5 h for eight days, recording each mass reading. If weekend weighings are to be eliminated and the results averaged for the weekends, then the test shall be started on a Monday.

6.4.10 After each weighing, invert the assembly to drain the hose, gently mix the liquid and refill the hose as in 6.4.7 and replace in the storage position.

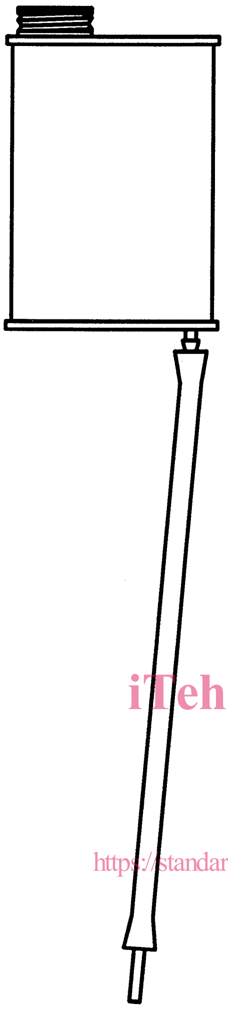

Figure 4 — Air bubble removal position

6.5 Expression of results

6.5.1 Determine the highest 24-h mass loss Δm_{24}, in grams, over the eight-day period.

6.5.2 Calculate the exposed tube area A, in square metres, from the equation

$$A = \pi \times d \times l \times 10^{-6}$$

where d and l are as defined in 5.6.2.

6.5.3 Calculate the rate of evaporation of the liquid, in grams per square metre per 24 h, from the formula

$$\frac{\Delta m_{24}}{A}$$

where

Δm_{24} is as defined in 6.5.1;

A is as defined in 6.5.2.

6.6 Test report

The test report shall include the following information:

a) a full description of the hose or tubing tested;

b) a reference to this International Standard;

c) the test method (method B);

d) the test liquid;

e) the evaporation rate, expressed as grams lost per square metre per 24 h;

f) the test temperature used;

g) the date of the test.

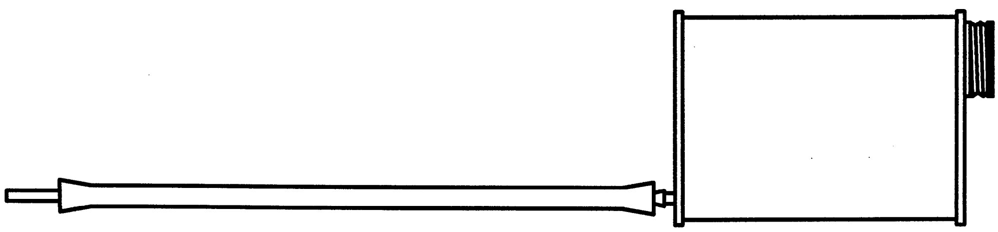

Figure 5 — Test assembly storage position

UDC 621.643.2/.3-036:620.165.29

Descriptors: rubber products, plastics products, pipes (tubes), plastic tubes, hoses, rubber hoses, plastic hoses, tests, determination, permeability, test equipment.

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