International Standard 1746

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Rubber or plastics hoses and tubing — Bending tests

Tuyaux et tubes en caoutchouc ou en plastique — Essais de courbure

Second edition — 1983-11-01

UDC 621.643.33 : 620.177 **Ref. No. ISO 1746-1983 (E)**

Descriptors: rubber products, plastics products, plastic tubes, hoses, rubber hoses, tests, bend tests.

Price based on 4 pages

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1746 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*, and was circulated to the member bodies in June 1982.

It has been approved by the member bodies of the following countries:

Australia	Hungary	Spain
Austria	India	Sri Lanka
Belgium	Korea, Rep. of	Sweden
Canada	Malaysia	Thailand
China	Netherlands	Turkey
Czechoslovakia	New Zealand	United Kingdom
Denmark	Poland	USA
Egypt, Arab Rep. of	Portugal	USSR
France	Romania	
Germany, F.R.	South Africa, Rep. of	

No member body expressed disapproval of the document.

This second edition cancels and replaces the first edition (i.e. ISO 1746-1976).

Rubber or plastics hoses and tubing — Bending tests

1 Scope and field of application

This International Standard specifies two methods for the determination of the behaviour of rubber or plastics hoses or tubing when bent to a specified radius.

Method A is suitable for hoses and tubing of bore sizes up to about 80 mm; the size of the apparatus for testing hoses and tubing of larger bore sizes becomes excessive. The method also provides a means of measuring the force required to reach a specified bend radius, and the test may be carried out at a specified internal pressure.

In method B, the bending characteristics, including the force required for bending, may be determined over a range of temperatures from −60 °C to +200 °C. The nature of the apparatus, however, limits its applicability to hoses and tubing of small bore sizes, i.e. up to about 12,5 mm.

2 References

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

ISO 1826, *Rubber, vulcanized — Time-interval between vulcanization and testing — Specification.*

ISO 4671, *Rubber and plastics hose and hose assemblies — Methods of measurements of dimensions.*[1)]

3 Method A

3.1 Apparatus

The apparatus consists of two guides A and B, guide A being fixed in a plane and guide B being movable in that plane, parallel to, and in line with, guide A (see figure 2).

If it is desired to measure the force required to attain the specified radius of curvature, this may be done, for example, by means of a system of pulleys and weights (see figure 1). Care should be taken to minimize the effect of frictional resistance.

3.2 Test pieces

3.2.1 Types and dimensions

The test pieces shall consist either of complete manufactured lengths of hose or of suitable test lengths. If the manufactured length is shorter than the length required for the test, test pieces of adequate length (see 3.4) shall be specially manufactured.

3.2.2 Number

Unless otherwise specified, two test pieces shall be tested.

3.3 Conditioning of test pieces

No test shall be carried out within 24 h of manufacture.

For evaluations which are intended to be comparable, the test should, as far as possible, be carried out after the same time interval after manufacture. ISO 1826 should be followed for time between sample manufacture and testing.

Before testing, test pieces shall be conditioned for at least 16 h at a standard laboratory temperature and humidity (see ISO 471); this 16 h period may be part of the 24 h interval after manufacture.

3.4 Procedure

Determine the average external diameter D of the hose by means of a suitable measuring instrument as specified in ISO 4671.

Draw two parallel and diametrically opposed lines along the length of the hose. If the hose has natural curvature, one of the lines shall be on the outside of the curve. On each of these lines, mark a distance of $1{,}6C + 2D$ or 200 mm whichever is the longer, where C is twice the minimum bend radius specified in the appropriate specification, so that the marked distances are exactly opposed. This will ensure a sufficient length for the bend test and adequate support of the hose.

1) At present at the stage of draft.

Separate the guides A and B to a distance slightly less than $1{,}6C + 2D$. Place the hose between the guides so that the ends of the marked distances are parallel to the ends of the guides and remain in this position while the guides are closed to a distance of $C + 2D$ (see figure 2).

Check that the hose on each side is supported to a length of not less than D.

Measure the hose outside dimension, T, at any point in the curved portion of the hose (see figure 3).

4 Method B

4.1 Apparatus

4.1.1 Compression testing machine, with a rate of travel of the moving jaw of 100 mm/min, preferably provided with a chart recorder. A scale, graduated in millimetre divisions, is attached to the moving jaw to enable the bend diameter to be measured or, preferably, this may be determined from a graphical record.

4.1.2 Pair of twin channel shaped holders, fitted with end stops for the hose test pieces (see figure 4).

4.1.3 Thermostatically controlled environmental chamber, which can be fitted to the testing machine, with provision for access to enable the external diameter of the hose to be measured.

4.2 Test pieces

4.2.1 Types and dimensions

The test shall be carried out on two pieces, of equal length, of the hose or tubing under test. The length of the test pieces depends on the dimensions of the test piece holders and shall be $2G + 0{,}5\pi C$, where G is the length of the test piece holders (see figure 4) and C is twice the minimum bend radius specified in the appropriate specification. In no case shall the test pieces come into contact with the walls of the chamber and the length L shall always be less than the length of the enclosure.

4.2.2 Number

Unless otherwise specified, three sets of tests should be carried out.

4.3 Conditioning of test pieces

No tests shall be carried out within 24 h of manufacture.

For evaluations which are intended to be comparable, the test should, as far as possible, be carried out after the same time interval after manufacture. ISO 1826 should be followed for time between sample manufacture and testing.

Before testing, test pieces shall be conditioned in the straight condition or conforming to their natural curvature for 5 h in the environmental chamber (4.1.3) at the specified test temperature (see 4.4).

4.4 Test temperature

The test temperature will be specified in the appropriate hose specification.

4.5 Procedure

4.5.1 Measure the external diameter D at the mid-point of the test pieces in the unstressed condition by means of a suitable measuring instrument as specified in ISO 4671.

4.5.2 Install the test pieces between the holders with a large bend radius and the ends of the test pieces against the end tops. The curvature shall follow the natural curvature if any.

4.5.3 Start the machine and determine the force required to reach the specified bend radius.

NOTES

1 It is advantageous if the machine can be pre-set to stop when twice the specified bend radius C has been reached.

2 The force value obtained by direct reading or from a graphical record should be divided by two to obtain the bending force for a single test piece.

4.5.4 Measure the hose outside dimension, T, at any point in the curved portion of the hose.

5 Expression of results

For both method A and method B, calculate the value T/D using the mean value obtained. The value should be compared with the permitted deformation given in the appropriate hose specification.

6 Test report

The test report shall include the following information:

a) a reference to this International Standard and the method used;

b) a full description of the hose or tubing tested and a reference to the hose specification in accordance with which the hose was tested;

c) the test temperature;

d) the internal pressure at which the test was carried out;

e) observations on any abrupt change(s) in hose section or irregularity in curvature caused by kinking;

f) the value for D, T, and T/D;

g) whether T/D is within the permitted deformation;

h) the force required to reach the specified bending radius, if appropriate.

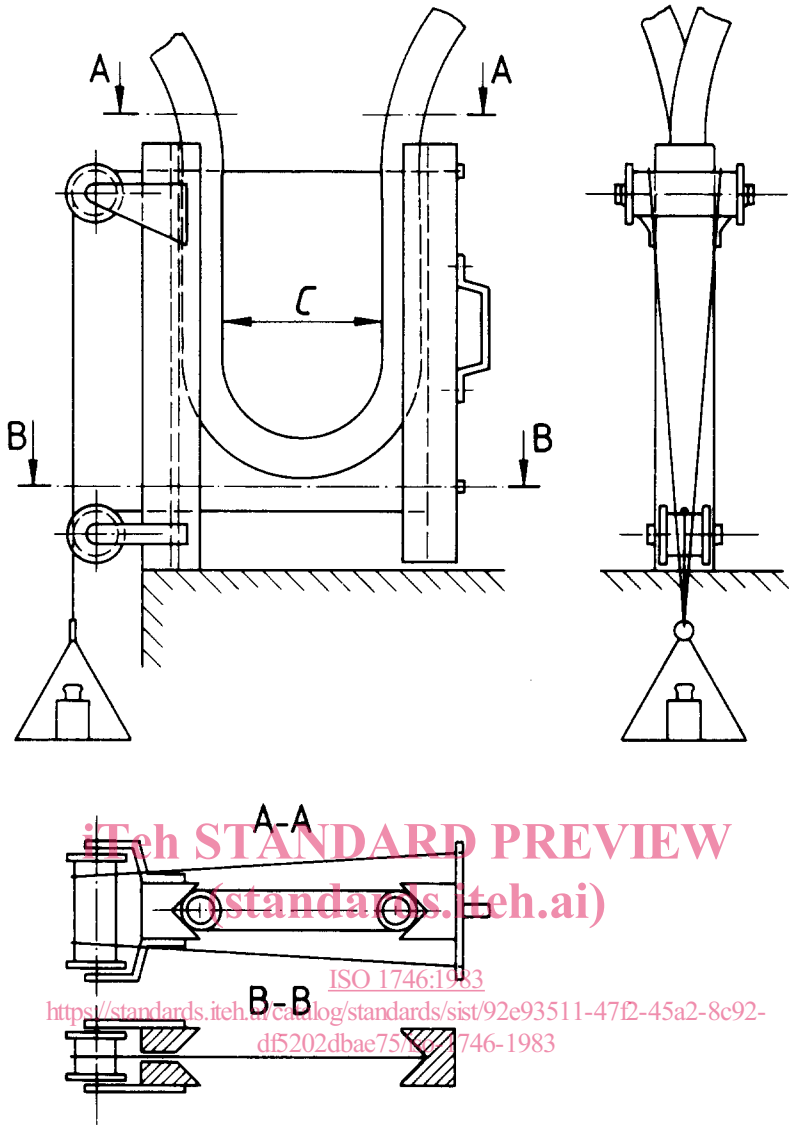

Figure 1 — Method A — Arrangement for measuring bending force

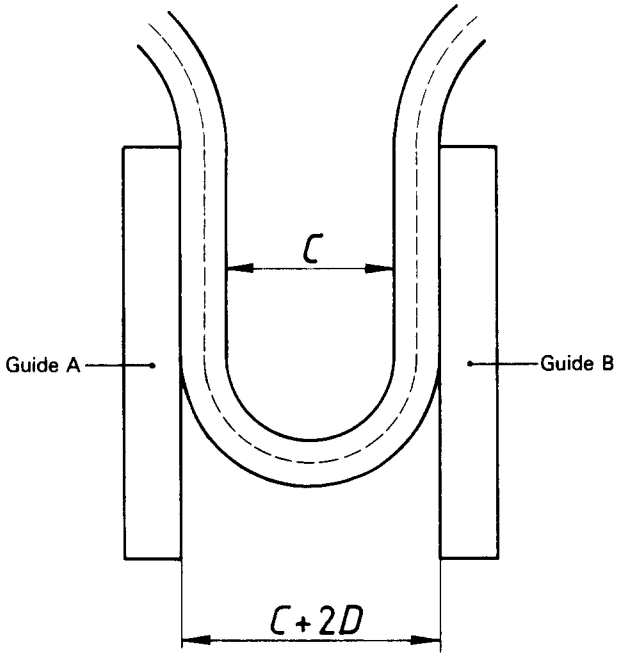

Figure 2 — Schematic arrangement for method A

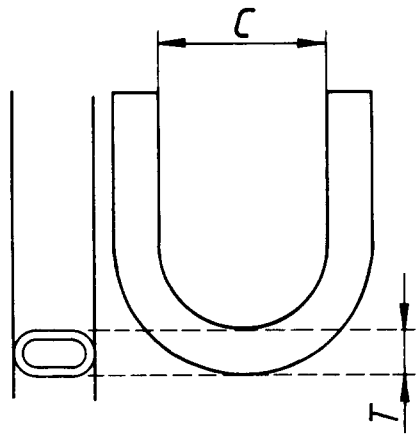

Figure 3 — Measurement of coefficient of deformation

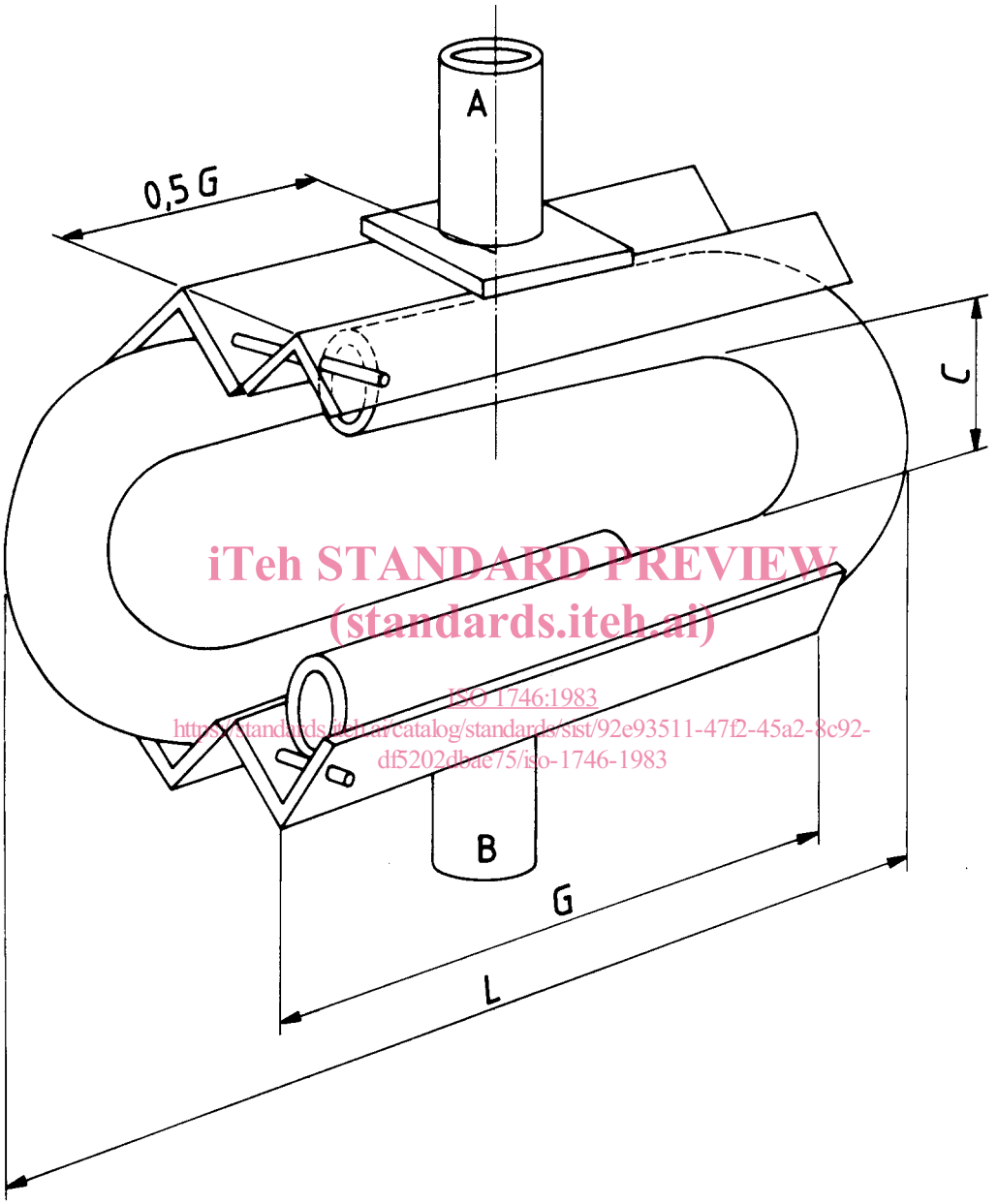

Figure 4 — Schematic arrangement for method B