International Standard ISO 8033

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Rubber and plastics hose — Determination of adhesion between components

Tuyaux en caoutchouc et en plastique — Détermination de l'adhérence entre éléments

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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.

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. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8033 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products.*

Rubber and plastics hose — Determination of adhesion between components

0 Introduction

Adequate adhesion between the various components of a hose is essential if it is to perform satisfactorily in service.

1 Scope and field of application

This International Standard specifies methods for the determination of the adhesion between lining and reinforcement, cover and reinforcement and between reinforcement layers. It covers all bore sizes and the following types of hose construction:

- woven textile fabric
- braided yarns
- spiralled yarns
- knitted yarns
- circular woven yarns
- textile cord fabric
- braided wires
- spiralled wires
- hoses containing a supporting helix

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 5893, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Description.*

ISO 6133, *Rubber and plastics — Analysis of multi-peak traces obtained in determinations of tear strength and adhesion strength.*

3 Principle

Measurement of the adhesion strength between lining and reinforcement, cover and reinforcement, and between reinforcement layers, under specified conditions using test pieces of standard dimensions.

4 Apparatus

A test machine having the following characteristics is required.

4.1 The machine shall be power driven, equipped with a suitable dynamometer, capable of maintaining a substantially constant rate of traverse of the moving head during the test and fitted with an autographic recorder. It shall comply with the requirement for grade A of ISO 5893.

NOTE — An inertialess dynamometer should be used.

4.2 The grips shall be capable of holding the test piece without slippage.

NOTE — Self-tightening grips are recommended.

For strip test pieces, provision shall be made to maintain the strip in the appropriate plane of the grips during the test, for example by the attachment of sufficient weights to the free end of the test piece or by fitting a supporting plate, coated with a low friction material such as polytetrafluoroethylene (PTFE), to the non-driven grip.

4.3 For testing a ring test piece, a mandrel shall be provided that is a close sliding fit in the test piece. This mandrel shall be capable of being fitted into the driven head of the machine so that it will rotate freely during the test (type 6).

5 Test pieces

5.1 Types of test piece

Seven types of test pieces are specified to cover the range of hose construction for methods and bore size normally encountered.

5.1.1 Type 1

Ring, cut from the hose 25 ± 0,5 mm wide and cut transversely to form a strip.

5.1.2 Type 2

Strip, 160 mm × 0,5 hose circumference.

5.1.3 Type 3

Ring, cut from the hose 35 ± 0,5 mm wide and cut transversely to form a strip.

5.1.4 Type 4

Strip, 160 mm × 0,5 hose circumference or 10 mm whichever is smaller.

5.1.5 Type 5

Strip, 160 mm long × 0,5 hose circumference.

5.1.6 Type 6

Ring, 35 ± 2 mm wide.

5.1.7 Type 7

Strip, cut along a reinforcing helix, 25 ± 0,5 mm wide or the maximum obtainable.

5.2 Test piece selection

Unless specified in the particular product standard or otherwise agreed between the interested parties the type of test piece should be selected from the table. Results obtained with different test pieces and/or hoses of the same construction of different diameters are not comparable.

5.3 Test piece preparation

5.3.1 Type 1

Cut a ring 25 ± 0,5 mm wide from the hose at right angles to its longitudinal axis. Cut the ring transversely and open it out to form a strip (see figure 1).

NOTE — The samples should be prepared by a method that does not cause high temperatures due to the cutting blade. Where heat build-up might cause a deterioration of properties, type 2, 3, 5 or 6 samples should be used.

5.3.2 Type 2

Cut the test piece in half longitudinally. From one of the halves make two cuts parallel to the axis of the test piece 25 ± 0,5 mm, 10 ± 0,5 mm or 5 ± 0,2 mm apart, depending on the width available, taking care not to cut through the yarns.

Separate a layer for a distance sufficient to enable the separated ends to be held in the grips of the test machine (see figure 2).

5.3.3 Type 3

Cut a ring 35 ± 2 mm wide from the hose at right angles to its longitudinal axis. Cut the ring transversely and open it to form a strip.

Make two cuts parallel to the hose axis 25 ± 0,5 mm apart, taking care not to cut through the yarns.

Separate a layer for a distance sufficient to enable the separated ends to be held in the grips of the test machine (see figure 3).

5.3.4 Type 4

Cut the test piece in half longitudinally. Cut from one of the halves a strip 10 ± 0,5 mm wide, or of the maximum width obtainable if less than 10 mm.

Separate a layer for a distance sufficient to enable the separated ends to be held in the grips of the test machine (see figure 4).

Table — Test piece selection

Hose construction	Adhesion between	Hose nominal bore size, d (mm)		
		$d \leq 20$	$20 < d \leq 50$	$d > 50$
Textile woven fabric Textile braided Textile knitted Textile circular woven	Lining and reinforcement Reinforcement layers Cover and reinforcement	Type 4 Type 4 Type 4	Type 1 Type 1 Type 1	Type 1 Type 1 Type 1
Textile spiral Textile cord fabric	Lining and reinforcement Reinforcement layers Cover and reinforcement	Type 2 Type 2[1)] Type 2	Type 3 Type 2 or 3[1)] Type 3	Type 3 Type 3[1)] Type 3
Wire braid Wire spiral	Lining and reinforcement Reinforcement layers Cover and reinforcement	Type 5[2)] —[3)] Type 2 or 6	Type 5 —[3)] Type 2 or 6	Type 5 —[3)] Type 2 or 6
Hoses containing a supporting helix	Lining and reinforcement Reinforcement layers Cover and reinforcement	Type 7 Type 7 Type 7	Type 7 Type 7 Type 7	Type 7 Type 7 Type 7

1) If the determination of adhesion is affected by the difficulty of obtaining a cleanly separating interface because of fraying of the yarns, indicate this in the test report.

2) Determination is impracticable below 12,5 mm bore size since insufficient test piece width is available.

3) Determination is impracticable since the wire braid or spiral layers tend to disintegrate and the result is in any case significantly affected by the forces required to bend the wires.

5.3.5 Type 5

Cut the test piece in half longitudinally. Using a twin bladed tool, cut a centrally located longitudinal strip 5 ± 0,2 mm wide through the lining and open up one end of the test piece to form a lip (see figure 5).

5.3.6 Type 6

Cut a ring 35 ± 2 mm wide, from the hose at right angles to its longitudinal axis. Make two circumferential cuts through the cover 25 ± 0,5 mm apart and located centrally on the specimen. Make a transverse cut across the 25 mm width through the cover and open up on one side of the cut to form a lip (see figure 6).

5.3.7 Type 7

Obtain a strip from the hose wall by cutting along the reinforcing helix and trim to 160 mm long, 25 ± 0,5 mm wide or the maximum obtainable less than 25 mm (see figure 7).

NOTE — This is an optional test where helix reinforced hoses are made in long lengths. It does not apply to hoses made to individual lengths, with special ends, built-in fittings, etc. It is only applicable if the spacing between individual helices is greater than 10 mm.

5.4 Conditioning of test pieces

No tests shall be carried out within 24 h of manufacture. Test pieces shall be conditioned at standard laboratory temperature and humidity (see ISO 471) before testing for at least 16 h; this may be part of the 24 h after manufacture.

5.5 Time interval between vulcanization and testing

For evaluations intended to be comparable the tests 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.

6 Procedure

6.1 A separate test piece shall be used for each interface to be tested.

6.2 Take the test piece from the conditioning atmosphere and measure the actual width of the test piece. Fix the separated ends of the test piece in the grips of the testing machine and adjust so that the tension is distributed uniformly and that no twisting of the test piece occurs during the test.

Place the test piece in the grips so that the angle of separation is approximately 180° for strip or 90° for ring test pieces.

It is important to ensure that the pulling force acts in the plane of separation.

6.3 The rate of travel of the power-driven grip shall be such as to provide a rate of ply separation of 50 ± 5 mm/min.

6.4 Start the machine and record the force, in newtons, over a length of separation of at least 100 mm or the maximum distance possible if the test piece is less than 100 mm long.

If separation occurs at any other point, for example inside either component under test, note this failure and report the force at which it occurs.

7 Expression of results

The tracing obtained from the graphical recorder shows the variations in the force at which the plies or layers have separated.

Determine the median peak force from the trace using the appropriate method specified in ISO 6133. Divide the median peak force by the effective width of the test piece and express the adhesion strength in kilonewtons per metre.

8 Test report

The test report shall contain the following information:

a) the hose type and nominal bore;

b) the date of manufacture and batch number or reference, as applicable;

c) the method of manufacture and details of reinforcement;

d) a reference to this International Standard;

e) type(s) of test piece used;

f) if appropriate, the adhesion, expressed in kilonewtons per metre of width, between lining and reinforcement;

g) if appropriate, the adhesion, expressed in kilonewtons per metre of width, between layers of reinforcement, noting any difficulties [see note 1) to the table];

h) if appropriate, the adhesion, expressed in kilonewtons per metre of width, between cover and reinforcement;

j) the date of test.

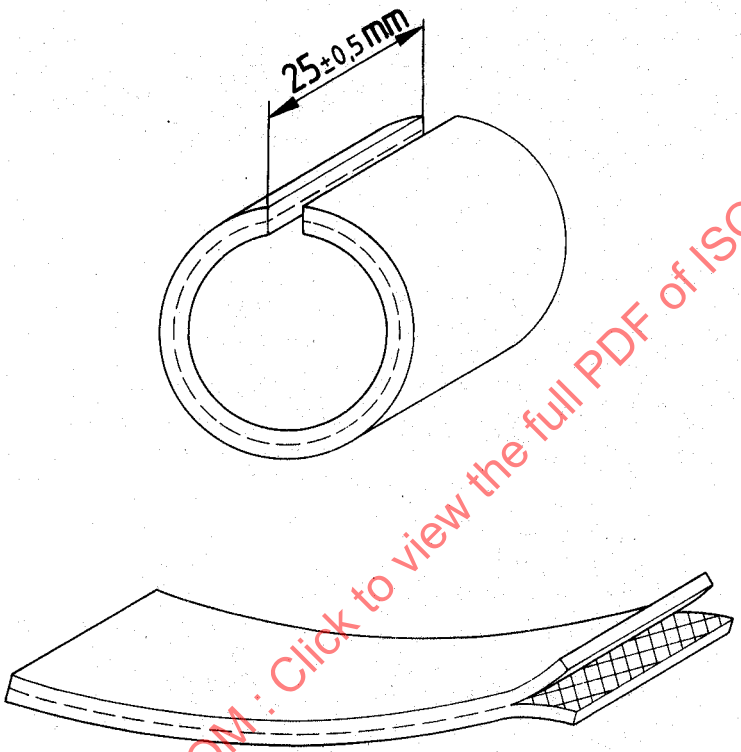

Figure 1 — Type 1, test piece

Dimensions in millimetres

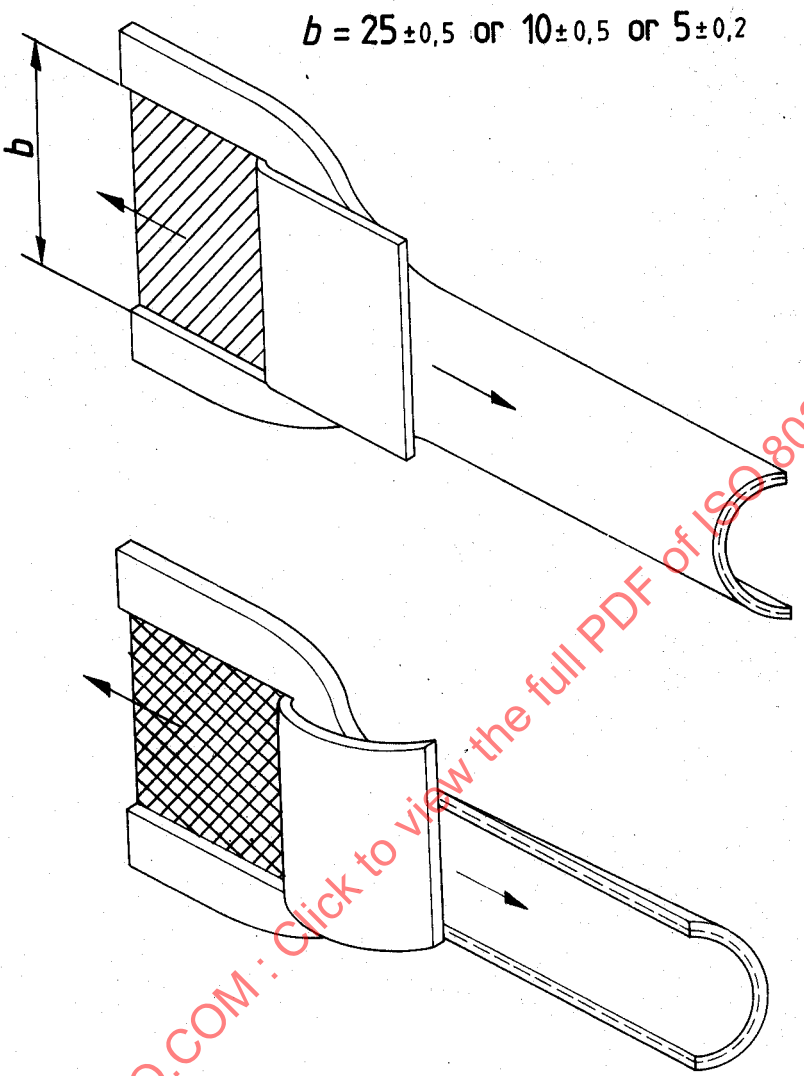

Figure 2 — Type 2, test piece

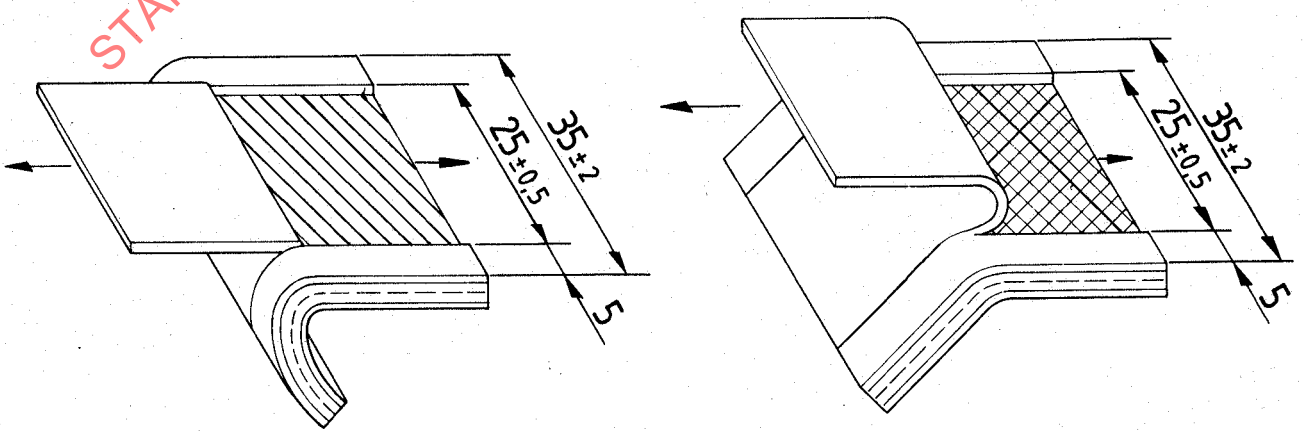

Figure 3 — Type 3, test piece

Dimensions in millimetres

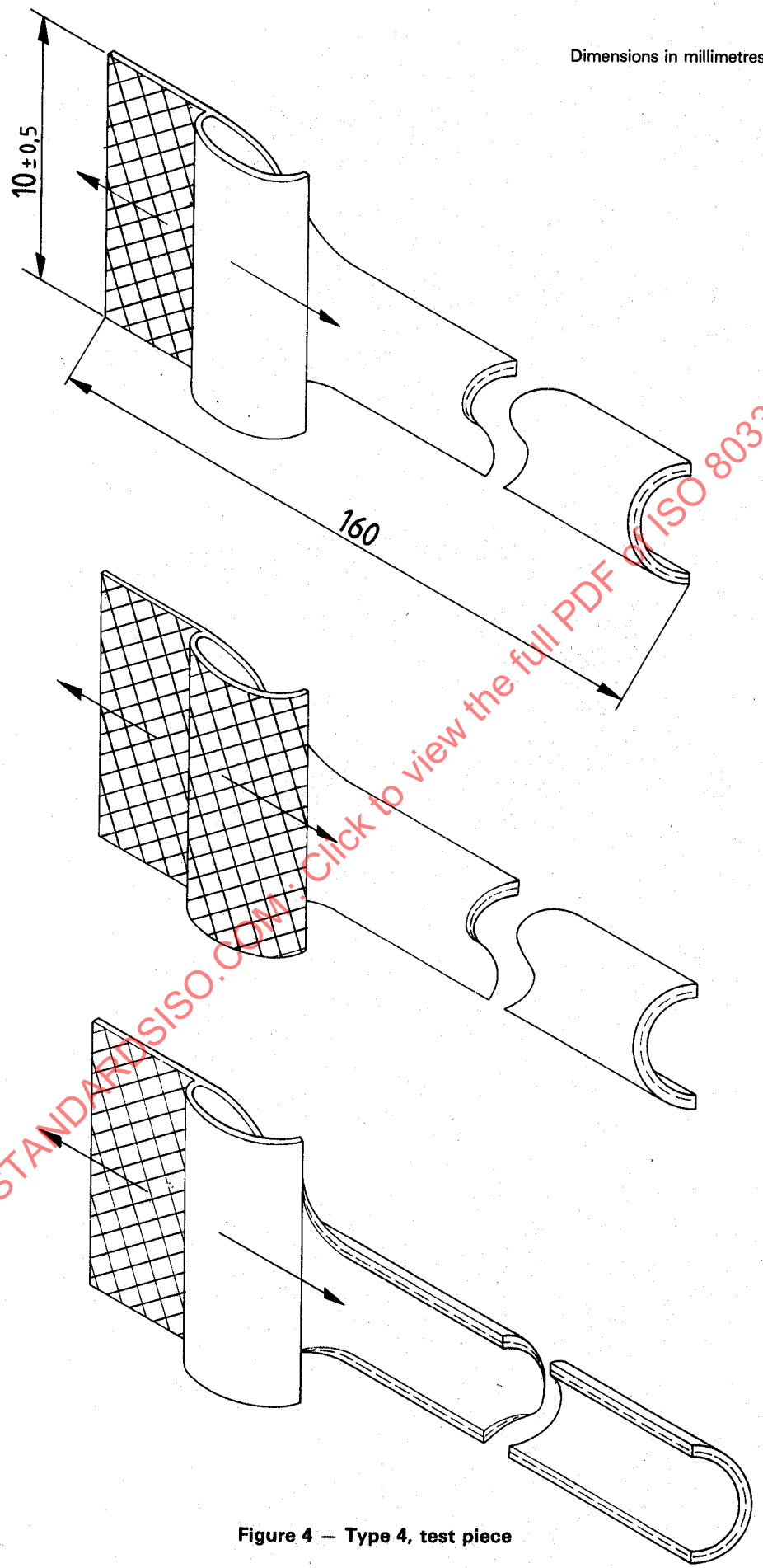

Figure 4 — Type 4, test piece