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Rubber hoses for agricultural spraying (ISO 1401:2016)

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National foreword

This British Standard is the UK implementation of EN ISO 1401:2016. It supersedes BS EN ISO 1401:2000 which is withdrawn.

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European foreword

This document (EN ISO 1401:2016) has been prepared by Technical Committee ISO/TC 45 "Rubber and rubber products" in collaboration with Technical Committee CEN/TC 218 “Rubber and plastics hoses and hose assemblies” the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2017, and conflicting national standards shall be withdrawn at the latest by May 2017.

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Endorsement notice

The text of ISO 1401:2016 has been approved by CEN as EN ISO 1401:2016 without any modification.

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 1, *Rubber and plastics hoses and hose assemblies*.

This third edition cancels and replaces the second edition (ISO 1401:1999), which has been technically revised.

The main changes are the following:

— the word "agropharmaceutical" has been replaced with "agricultural chemicals";

— Clause 2 has been updated: ISO 471 and ISO 1746 have been deleted and replaced by ISO 23529 and ISO 10619-1;

— 7.2 has been amended to update the test requirements;

— Clauses 9 and 10, describing frequency of testing, routine tests, type tests and production acceptance tests, have been added;

— Clause 8 has been renumbered as Clause 12: Marking b) and e) has been amended;

— Annexes A and B have been introduced in accordance with ISO/TC 45/SC 1 guide 976-rev. 7:2013;

— Clause 11, describing a test report or certificate supplied on request of purchaser, has been added.

Rubber hoses for agricultural spraying

1 Scope

This document specifies requirements for three types of flexible rubber hose for pressure spraying of agricultural chemicals and/or fertilizer products within a temperature range of –10 °C to +60 °C.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 188, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 1307, *Rubber and plastics hoses — Hose sizes, minimum and maximum inside diameters, and tolerances on cut-to-length hoses*

ISO 1402, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

ISO 4671, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

ISO 7326:2006, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions*

ISO 8033, *Rubber and plastics hoses — Determination of adhesion between components*

ISO 10619-1, *Rubber and plastics hoses and tubing — Measurement of flexibility and stiffness — Part 1: Bending tests at ambient temperature*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8330 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

4 Classification

Three types of hose are specified as follows:

— **Type A**: Maximum working pressure of 1,0 MPa (10 bar);

— **Type B**: Maximum working pressure of 4,0 MPa (40 bar);

— **Type C**: Maximum working pressure of 6,0 MPa (60 bar).

5 Construction and materials

The hose shall consist of the following:

— a synthetic rubber lining;

— a reinforcement of one or more layers of textile fibres;

— a cover of natural or synthetic rubber.

6 Dimensions and tolerances

6.1 Nominal bore and inside diameter

The dimensions of the hose shall be in accordance with the inside diameter and tolerances given in Table 1.

Table 1 — Nominal bores, diameters and tolerances

Nominal bore diameter	Inside diameter mm	Tolerance mm
6,3	6,30	±0,75
8	8,00	±0,75
10	10,00	±0,75
12,5	12,50	±0,75
16	16,00	±0,75
20	20,00	±0,75
25	25,00	±1,25

6.2 Length

The tolerance on lengths shall be as specified in ISO 1307.

6.3 Minimum thickness of lining and cover

6.3.1 Types A and B

When tested in accordance with ISO 4671, the lining shall have a minimum thickness of 1,6 mm and the cover shall have a minimum thickness of 1,0 mm.

6.3.2 Type C

When tested in accordance with ISO 4671, the lining shall have a minimum thickness of 2,0 mm and the cover shall have a minimum thickness of 1,6 mm.

7 Physical requirements on samples taken from the hose or from moulded sheets of equivalent vulcanization

7.1 Tensile strength and elongation at break of rubber lining and cover

When determined in accordance with ISO 37, the tensile strength and elongation at break shall be no less than the values given in Table 2.

Table 2 — Tensile strength and elongation at break

Hose component	Tensile strength MPa	Elongation at break %
Lining	7,0	200
Cover	7,0	250

7.2 Requirements after immersion in fluid

When tested in accordance with ISO 1817, after immersion for 72 h ± 2 h in the actual liquid which the hose will convey during service in purchaser's system, at standard laboratory temperature (see ISO 23529), the lining and cover shall conform to the values given in Table 3.

The specification of the test liquid shall be obtained from the purchaser by the hose manufacturer (or dealer), alternatively a sample of sufficient quantity to carry out the test shall be obtained from the client. Each test shall be carried out with a new sample of test liquid which has not been stored past its product tenability date.

Table 3 — Requirements after immersion in test liquid

Property	Requirement
Volume	Maximum increase 55 %
Tensile strength	Maximum reduction 50 %
Elongation at break	Maximum reduction 40 %

7.3 Accelerated ageing

For liner and cover, after ageing the sample in air for 72 ± 2 h at 100 °C ± 2 °C, as specified in ISO 188, the tensile strength and elongation at break as determined by ISO 37 shall decrease by no more than 25 % and 50 % respectively from their initial values.

8 Physical requirements on finished hoses

8.1 Change in dimensions

When the hose is tested at proof pressure in accordance with ISO 1402, the changes in outside diameter and length shall be no greater than ±7 % and there shall be no leaks or other signs of damage.

8.2 Hydrostatic requirements

8.2.1 Hydrostatic pressure

When tested in accordance with ISO 1402, the hose shall meet the requirements given in Table 4.

Table 4 — Hydrostatic pressure requirements

Hose type	Working pressure		Proof pressure		Minimum bursting pressure	
	MPa	bar	MPa	bar	MPa	bar
A	1	10	2	20	4	40
B	4	40	8	80	16	160
C	6	60	12	120	24	240

8.2.2 Hydrostatic testing after ageing in liquid

A 1 m length of hose shall be filled with the liquid to be used in the hose and aged for 336 h ± 2 h at standard laboratory temperature (see ISO 23529). After ageing, the hose shall be drained and hydrostatically tested after 1 h in accordance with ISO 1402. The hose shall meet the requirements given in Table 4.

8.3 Bending test requirements

When determined in accordance with ISO 10619-1 using a minimum radius of curvature of 10 times the nominal bore, the value of the ratio of hose outside dimension, during bending, to the original outside diameter, *T*/*D*, shall be a minimum of 0,80.

8.4 Adhesion

When determined in accordance with ISO 8033, the adhesion between the various components shall be no less than 1,5 kN/m.

8.5 Resistance to ozone

When tested in accordance with ISO 7326:2006, method 1, the test piece shall show no signs of cracking.

9 Frequency of testing

The minimum frequency of testing (routine tests and type tests) shall conform to the schedule given in Annex A. The recommended frequency of production acceptance testing carried out per batch is given in Annex B and is for guidance only.

Routine tests are those tests carried out on each length of finished hose.

Type tests are those tests carried out in order to verify that the hose design, materials and method of manufacture meet all the requirements of this document.

Production acceptance tests are those tests carried out per batch by manufacturer to monitor the quality of production.

10 Type testing

Type tests are carried out by manufacturer to confirm that all the materials, construction and test requirements of this document have been met by the method of manufacturing and design. Type testing shall be repeated at a maximum of 5 years or whenever a change in design, method or manufacture or materials occurs. Type testing shall be performed for all sizes and types except those of same size and construction.

11 Test report or certificate

Upon purchasers' request, the manufacturer shall supply a test report or certificate positively identifying the hoses supplied to the purchaser.

12 Marking

Each length of hose shall be clearly and durably marked, at least every 1 m, with at least the following information:

a) the manufacturer's name or identification (XXXX);

b) the number of this document and date of publication, i.e. ISO 1401:2016;

c) the hose type;

d) the nominal bore;

e) the maximum working pressure, in MPa and in bar, with the units stated;

f) the quarter and year of manufacture.

EXAMPLE XXXX ISO 1401:2016 type B – 4 MPa/40 bar – 3Q16.

Annex A
(normative)

Type tests and routine tests

Table A.1 gives the tests to be carried out for the type and routine testing as defined in Clause 9.

Table A.1 — Required type test and routine test

Property	Type test	Routine tests
Compound tests		
Tensile strength/elongation at break of lining and cover: 7.1	X	NA
Requirements after immersion in fluid, lining and cover: 7.2	X	NA
Resistance to ageing, lining and cover: 7.3	X	NA
Hose tests		
Nominal bore and inside diameter measurement: 6.1	X	X
Tolerance on length: 6.2	X	X
Minimum thickness of lining and cover: 6.3	X	X
Hydrostatic test: 8.2.1	X	X
Change in dimensions at test pressure: 8.1	X	X
Hydrostatic testing after ageing in liquid: 7.2 and 8.2.2	X	X[a]
Bending test: 8.3	X	NA
Adhesion between the various components: 8.4	X	NA
Resistance to ozone: 8.5	X	NA
Burst strength before ageing in liquid: Table 4	X	NA
Burst strength after ageing in the liquid conveyed in service: 7.2		X[a]

X Test shall be carried out.

NA Test not applicable.

[a] For special (non-standard) agricultural chemicals, the hydrostatic tests and burst tests after ageing shall be carried out on hose types which have not been type tested with this liquid before.

Annex B
(informative)

Productions acceptance tests

Table B.1 gives the recommended frequency of production acceptance tests (see Clause 9) to be carried out per batch or every 10 batches of identical hose as indicated in the table.

A batch is identified as either 500 m of hose or 10 000 kg of lining and/or cover compound.

Table B.1 — Recommended test frequency

Property	Production acceptance tests	
Compound tests	Per batch	Every 10 batches
Tensile strength/elongation of break lining/cover: 7.1	X	X
Requirements after immersion in fluid, lining/cover: 7.2	NA	X
Resistance to ageing, lining and cover: 7.3	NA	X
Hose tests		
Nominal bore/inside diameter measurement: 6.1	NA	NA
Tolerance on length: 6.2	NA	NA
Hydrostatic test: 8.2.1	NA	NA
Change in dimensions at test pressure: 8.1	NA	NA
Hydrostatic testing after ageing in liquid: 7.2 and 8.2.2	X	X
Bending test: 8.3	X	X
Adhesion between the various components: 8.4	X	X
Resistance to ozone: 8.5	NA	X
Burst strength before ageing in liquid: Table 4	NA	X
Burst strength after ageing in the liquid conveyed in service: 7.2	NA	X
X Test carried out. NA Test not applicable.		

Bibliography

[1] ISO 8330, *Rubber and plastics hoses and hose assemblies — Vocabulary*

[2] ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

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