INTERNATIONAL STANDARD

ISO 16438

First edition
2012-12-01

Agricultural irrigation equipment — Thermoplastic collapsible hoses for irrigation — Specifications and test methods

Matériel agricole d'irrigation — Tuyaux écrasables en matières thermoplastiques pour l'irrigation — Spécifications et méthodes d'essai

Reference number
ISO 16438:2012(E)

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16438 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 18, *Irrigation and drainage equipment and systems*.

Introduction

Thermoplastic collapsible hoses have been introduced to agricultural irrigation projects in recent years, e.g. as headers supplying drip tape systems or as replacement for gated pipes.

Thermoplastic collapsible hoses for *irrigation* are a special "breed" of hoses. They have a unique combination of attributes and requirements, that are not covered by any other existing ISO International Standard, thus justifying the preparation of a separate, dedicated standard. These aspects include:

— equal and accurate spacing of multiple outlet connections;

— very low elongation and amount of twist under pressure;

— resistance to most fertilizers and other chemicals employed in irrigation;

— protection against degradation by UV radiation;

— impermeability to incident light;

— defined pressure loss data.

This International Standard is intended to cover all these aspects by specifying the requirements and the applicable test methods.

Agricultural irrigation equipment — Thermoplastic collapsible hoses for irrigation — Specifications and test methods

1 Scope

This International Standard specifies requirements and test methods for reinforced and non-reinforced thermoplastic collapsible hoses, which are intended to be used as main and sub-main supply lines for the conveyance and distribution of water for irrigation at water temperatures up to 50 °C.

It is applicable to irrigation hoses with nominal diameters between 40 mm and 500 mm and working pressures between 0,3 bar (0,03 MPa) and 6 bar (0,6 MPa).

This International Standard is applicable to two types of hose configurations: distributor hose (with outlet connections) and plain hose (without outlet connections).

2 Normative references

The following referenced documents are indispensable for the application 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 1402:2009, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing*

ISO 4671:2007, *Rubber and plastics hoses and hose assemblies — Methods of measurement of the dimensions of hoses and the lengths of hose assemblies*

ISO 4892-3:2006, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO 7686:2005, *Plastics pipes and fittings — Determination of opacity*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
hose
flexible tube used for conveying water under pressure

3.2
collapsible hose
hose which, when not under internal pressure, collapses to such an extent that the inner faces of the bore almost touch or make contact and the hose cross-section appears flat

NOTE Adapted from ISO 8330:2007, definition 2.1.74.

3.3
reinforced hose
hose which has a layer of a material or other component incorporated in its wall which serves to increase its strength

3.4
non-reinforced hose
hose which has no reinforcing layer or component incorporated

3.5
water outlet connections
connection points for irrigation laterals in hose wall, equally spaced along its length

3.6
maximum working pressure
maximum operating pressure
MOP
highest water pressure in a hose recommended by the manufacturer to ensure proper operation

3.7
nominal diameter
numerical designation used to refer to the size of the hose, approximately equal to the actual internal diameter of the hose

3.8
twisting
angular deflection of a hose created when pressurized by rotation of one of its ends relative to its other end

3.9
warping
deviation of a hose centreline from straight when pressurized

NOTE Adapted from ISO 8330:2007, definition 2.1.147.

4 Classification

Hoses are classified as one of the following two types:

a) **Plain hose** – hose without any outlets;

b) **Distributor hose** – hose having multiple water outlet connections along its length.

5 Material

The hoses shall be made of thermoplastic materials.

The hoses shall be opaque and protected against degradation by solar (UV) radiation and other environmental effects. They shall be resistant to fertilizers and other chemicals commonly employed in agricultural irrigation.

6 Marking

Each hose shall bear clear and durable marking, repeated at intervals of not more than 10 m, including the following details:

a) manufacturer's name or trademark;

b) the word **IRRIGATION**;

c) nominal diameter;

d) maximum working pressure;

e) production year and month;

f) the number of this International Standard: **ISO 16438**.

7 Dimensions

7.1 Inside diameter

When measured in accordance with ISO 4671, the inside diameter of a hose shall not deviate by more than ± 2 % from the inside diameter declared by the manufacturer.

7.2 Length

The total length of hose supplied, when measured at ambient temperature in straight, uncoiled condition, shall not be less than the length declared by the manufacturer.

7.3 Spacing of outlet connections

Measure the spacing (distance between centres) of five consecutive outlet connections to the nearest 1 mm.

The actual spacing shall not deviate by more than ± 5 % from the spacing declared by the manufacturer and the absolute value of the sum of all signed (**+** or **–**) deviations, shall not exceed 5 %.

8 Fittings

For each size of hose, the manufacturer shall be able to present suitable fittings to make secure connections between hoses and between the hose and common water sources.

The fittings shall be watertight and withstand the maximum working pressure of the hoses to which they are connected.

9 Hydrostatic and hydraulic characteristics

9.1 Proof pressure test

Perform the test in accordance with ISO 1402:2009 Subclause 8.1, for a duration of one hour and at a water temperature of 50 °C. Test pressure shall be as indicated in Table 1.

Table 1 — Proof test pressure

Maximum working pressure of the hose	Test pressure
P_{max} bar (MPa)	bar (MPa)
from 0,3 bar (0,03 MPa) up to 1,5 bar (0,15 MPa)	1,5 x P_{max}
above 1,5 bar (0,15 MPa) up to 4,0 bar (0,40 MPa)	1,8 x P_{max}
above 4,0 bar (0,40 MPa) up to 6,0 bar (0,60 MPa)	3,0 x P_{max}

While testing distributor hose, ensure that the test piece includes at least one outlet, which is sealed according to the hose manufacturer's instructions.

The test piece shall not show any evidence of leakage, cracking, delamination, abrupt distortion or other signs of failure at the hose wall or, for distributor type hose, at any of the outlets.

9.2 Deformation under pressure and after relaxation

Perform the test in accordance with ISO 1402:2009 Subclause 8.2, for a duration of one hour and at a water temperature of 50 °C. Use a test pressure equal to the maximum working pressure of the hose.

At the end of one hour, while still under pressure, the following requirements apply:

— the measured change in length shall not exceed +1 %;

— for distributor type hose, the measured amount of twisting shall not exceed 0,1 °/m.

One hour after the complete removal of pressure, the following requirements apply:

— the remaining change in length from the start of the test shall not exceed +0,8 %;

— the remaining change in diameter from the start of the test shall not exceed +1,6 %.

9.3 Warping

Perform the test in accordance with ISO 1402:2009 Subclause 8.2.5, using water at 23°C. The sample length shall be at least 100 diameters but not less than 20 m. Use a test pressure equal to the maximum working pressure of the hose.

The measured amount of warping shall not exceed 5 mm per 1 m length.

9.4 Head loss

The head loss of the hoses shall be determined by the manufacturer, optionally using the calculation method given in ISO/TR 10501, and be reported in the manufacturer's documentation.

10 Physical characteristics

10.1 Opacity

When tested in accordance with ISO 7686, the percentage of incident light energy transmitted through the hose wall shall not exceed 0,2 %.

10.2 UV resistance

Perform the test in accordance with ISO 4892-3 for 1 500 h, using a cycle of 8 h UVB radiation at 60 °C followed by 4 h condensation at 50 °C. The hose shall not show signs of cracks or other defects rendering it unserviceable.

Bibliography

[1] ISO 8330: 2007, *Rubber and plastics hoses and hose assemblies — Vocabulary*

[2] ISO/TR 10501: 1993, *Thermoplastics pipes for the transport of liquids under pressure — Calculation of head losses*

[3] ISO 16149: 2006, *Agricultural irrigation equipment — PVC above-ground low-pressure pipe for surface irrigation — Specifications and test methods*

ICS 65.060.35

Price based on 5 pages