# INTERNATIONAL STANDARD

**ISO 8224-2**

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**Traveller irrigation machines —**

**Part 2:**
Softwall hose and couplings — Test methods



*Machines d'arrosage mobiles —*

*Partie 2: Tuyau flexible et raccords — Méthodes d'essai*



Reference number
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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.

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 8224-2 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

ISO 8224 consists of the following parts, under the general title *Traveller irrigation machines*:



— *Part 1: Laboratory and field test methods*

— *Part 2: Softwall hose and couplings — Test methods*



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# Traveller irrigation machines —

# Part 2:
Softwall hose and couplings — Test methods

## 1 Scope

This part of ISO 8224 specifies test methods for specific physical properties and accelerated durability tests for softwall irrigation hose and couplings used with irrigation machines.

It applies to such hose and couplings used with stationary hose-coiling, mobile hose-laying or hose-coiling, and mobile hose-dragging irrigation machines used in agriculture and forestry.



## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8224. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8224 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 1402:1984, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing.*

ISO 1421:1977, *Fabrics coated with rubber or plastics — Determination of breaking strength and elongation at break.*

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

ISO 7326:1984, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions.*

ISO 8033:1985, *Rubber and plastics hose — Determination of adhesion between components.*

ASTM D 412-87, *Standard test methods for rubber properties in tension.*

ASTM D 3389-87, *Standard test method for coated fabrics abrasion resistance (rotary platform, double-head abrader).*

## 3 Definitions

For the purposes of this part of ISO 8224, the following definitions apply.

**3.1 hose:** Flexible reinforced tube for conveying water, roughly round in cross-section when filled with water under normal operation pressure, and which may be collapsible when drained of water. The hose consists of a cover, a hydraulic load-bearing textile reinforcement, and an inner impermeable tube.

**3.2 elongation:** Increase in the hose length caused by pressurization.

**3.3 snaking:** Deviation in location of the hose from the original straight-line position, as laid down by the machine, caused by elongation.

**3.4 kinking:** Vertical transverse folding from the normally round configuration of a pressurized hose.

**3.5 pressure:** Internal pressure measured in kilopascals (kPa) at the inlet end of the hose or as otherwise designated.

## 4 Test equipment

**4.1 Pressure gauge** or other equipment capable of measuring pressure within a range from 0 to 3 300 kPa (0 to 33 bar) with a reading accuracy of ± 2 %.

**4.2 Dynamometer** or other equipment capable of measuring draft within a range of 0 to 250 kN.

**4.3 Test pump** capable of maintaining water pressures up to 3 300 kPa (33 bar).

**4.4 Wear test equipment** to perform an accelerated wear test.

**4.5 Tensile test equipment** capable of providing a tensile force of at least 250 kN.

**4.6 Length measurement equipment** with a reading accuracy of ± 1 mm.

## 5 Test conditions

The tests shall be carried out at an ambient temperature of 23 °C ± 3 °C. The test liquid shall be clear water at a similar temperature.



## 6 Test procedures

### 6.1 Adhesion of cover to fabric

**6.1.1** The mechanical or chemical adhesion of a hose cover to the fabric of the hose shall be tested according to procedures specified in ISO 8033.

**6.1.2** Results shall be recorded as specified in ISO 8033.

### 6.2 Adhesion of tube to fabric

**6.2.1** The mechanical or chemical adhesion of the tube to the fabric of the hose shall be tested according to procedures specified in ISO 8033.

**6.2.2** The results shall be recorded as specified in ISO 8033.

### 6.3 Ozone resistance

**6.3.1** The ozone resistance of the exterior layer of the hose shall be tested according to procedures specified in ISO 7326, Method 2 or 3, with the following modifications:

a) the elongation of the cover shall be 20 %;

b) the ozone concentration shall be maintained at 50 pphm ± 5 pphm and the air temperature at 40 °C ± 2 °C;

c) the test pieces shall be examined after 2 h, 4 h, 24 h, 48 h, 72 h, 96 h while still in extended condition.

**6.3.2** Record hours until cracks become visible under × 2 magnification. If no cracks occur before 96 h of testing, record as > 96 h.

### 6.4 Elongation by internal hydraulic pressure

**6.4.1** The elongation shall be tested according to the procedures specified in ISO 1402, except that the test piece shall be at least 3 m long. The elongation measurements shall be taken 1 min after the hose has stabilized at the pressures specified in 6.4.2 and 6.4.3.

**6.4.2** Two marks, at least five times the outside diameter apart, shall be made on the test piece when initially pressurized to 70 kPa. The distance between the marks ($l_1$) shall be measured within ± 1 mm along a straight line.

**6.4.3** Pressurize the test piece to 700 kPa and again record the distance ($l_2$) between the marks. The test piece shall be restrained to prevent snaking to ensure that distances are measured along the centreline.

**6.4.4** The percentage elongation shall be calculated as $100[(l_2 - l_1)/l_1]$ % and recorded.

### 6.5 Burst pressure

The burst pressure can be evaluated with the same test piece as that used to determine elongation (see 6.4). The length of the hose test piece shall be such that its free length is 1 m, excluding end reinforcement or couplings, and shall be tested according to ISO 1402.

Increase the water pressure at a constant rate, as specified in ISO 1402, until the hose bursts or a pressure of 2 500 kPa is reached. Record the burst pressure if less than 2 500 kPa, or record as > 2 500 kPa.

### 6.6 Tensile break force and elongation at break

**6.6.1** The procedure for testing hose for tensile break force and resultant elongation shall be that of ISO 1421, with the following modifications:

— The test piece shall be a longitudinal strip cut from the hose in the direction of the hose axis. This strip shall be long enough to leave exposed

a minimum of 0,3 m between the grips of the test machine. The width of the test piece shall be wide enough that a minimum of 10 % of the total design number of warp yarns in the hose circumference remain intact throughout the length of the test piece.

**6.6.2** Record the breaking force of the test piece. The breaking force of the hose is calculated by multiplying the break force per unit width (based on machine grip width) by the circumference of the hose.

**6.6.3** Record the elongation of the test piece at break. The percentage elongation at break shall be calculated as

$$100[(l_2 - l_1)/l_1]$$

where

$l_1$ is the distance between the machine grips before the load is applied, and

$l_2$ is the distance between the grips at break.

## 6.7 Kinking

### 6.7.1 General

This test applies only to hose intended for use with hose-dragging machines.

The test shall be performed on three hose pieces, randomly selected from different production batches.

### 6.7.2 Test preparation

**6.7.2.1** Lay a randomly selected hose test piece, at least 60 m long, in a straight line on a bare, smooth and level soil surface with one end connected to the source of water pressure and the other end plugged.

**6.7.2.2** Fill the test piece with water and pressurize it to an internal static pressure of 700 kPa. Bleed all air from the test piece.

**6.7.2.3** Then move the free end of the test piece so that it takes the form of the letter "J" as it does in actual field operation. The two legs of the "J"-shaped test piece shall be parallel and 15 times the outside hose diameter apart, but not more than 2 m apart.

### 6.7.3 Test procedure

**6.7.3.1** The test shall be performed with no water flowing.

**6.7.3.2** Tow the test piece by its movable end at a constant speed of 0,01 m/s along a straight path parallel with the longer leg of the "J"-shaped test piece for a distance of at least 6 m. Observe the loop of the hose for kinking.

**6.7.3.3** If no kinking is observed, repeat the test as many times as necessary at an internal water pressure (see 6.7.2.2) reduced by 50 kPa in each subsequent test until kinking does occur.

**6.7.3.4** Record internal static pressure at which kinking occurs as the kinking pressure of the test piece.

**6.7.3.5** Calculate the average of the recorded values for the three tests. This average shall be recorded and declared as the kinking pressure of the hose.

## 6.8 Accelerated wear

**6.8.1** This test is a means of simulating field wear conditions for the hose and shall be used for comparative purposes only.

**6.8.2** Conduct abrasion resistance tests on the hose according to methods specified in ASTM D 3389.

The abrasive wheels shall be Type H-22 grit.

The vertical weight on each abraser wheel shall be 10 N.

**6.8.3** Record the number of revolutions necessary to wear away the cover of the hose to just expose the fabric reinforcement.

## 6.9 Inside diameter

**6.9.1** Determine the inside diameter of the hose by a plug gauge according to the procedures specified in ISO 4671.

**6.9.2** Report the inside diameter as specified in ISO 4671.

## 6.10 Permanent set

**6.10.1** Test the permanent set of the elastomeric compound used as the tube lining of the hose according to methods specified in ASTM D 412.

**6.10.2** Calculate and report as the permanent set specified in ASTM D 412.

### 6.11 Hose and coupling assembly

Where hose and couplings are supplied as an assembly, the test procedures in 6.11.1 to 6.11.3 shall apply.

**6.11.1** Test coupling assemblies relative to bursting pressure and longitudinal pull. The coupling tests may be conducted at the same time as the hose tests.

**6.11.2** Test the coupling assembly for resistance to pressure according to 6.5. Record the failure pressure in kilopascals.

**6.11.3** Test the coupling assembly for resistance to longitudinal pull according to 6.6. Record the break force.

## 7 Test report

The test report shall include the data in 7.1 and 7.2.

### 7.1 Data supplied by manufacturer

a) manufacturer's/supplier's name and address;

b) hose description (construction and composition);

c) weight per unit length, in kilograms per metre;

d) working pressure of hose, in kilopascals;

e) elongation (rated), in percentage;

f) longitudinal strength (rated), in kilopascals;

g) external diameter at no pressure, in millimetres;

h) internal diameter at no pressure, in millimetres;

i) external diameter at 700 kPa pressure, in millimetres.

### 7.2 Test results

| Clause No. | Description | Units | Test results |
|---|---|---|---|
| 6.1 | Adhesion of cover to fabric | kN/m | |
| 6.2 | Adhesion of tube to fabric | kN/m | |
| 6.3 | Ozone resistance | hours | |
| 6.4 | Elongation by internal hydraulic pressure | % | |
| 6.5 | Burst pressure | kPa | |
| 6.6.2 | Tensile break force | kN | |
| 6.6.3 | Elongation | % | |
| 6.7 | Kinking | kPa | |
| 6.8 | Accelerated wear | revolutions | |
| 6.9 | Inside diameter | mm | |
| 6.10 | Permanent set | % | |
| 6.11.2 | Hose and coupling assembly resistance to burst | kPa | |
| 6.11.3 | Hose and coupling assembly resistance to longitudinal pull | kN | |

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