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**Agricultural irrigation equipment —  
PVC above-ground low-pressure pipe  
for surface irrigation — Specifications  
and test methods**

*Matériel agricole d'irrigation — Tube en PVC, posé au-dessus du sol et  
utilisé avec basse pression pour l'irrigation en surface — Spécifications  
et méthodes d'essai*

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## Foreword

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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 16149 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 18, *Irrigation and drainage equipment and systems*.

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# Agricultural irrigation equipment — PVC above-ground low-pressure pipe for surface irrigation — Specifications and test methods

## 1 Scope

This International Standard specifies the requirements for unplasticized polyvinyl chloride (PVC) piping, used to supply and to distribute low-pressure irrigation water through gates. It is applicable to PVC piping with diameters of from 50 mm to 315 mm, operating at low pressures and exposed to sunlight.

## 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 1167-1, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 1: General method*

ISO 1167-2, *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure — Part 2: Preparation of pipe test pieces*

ISO 2505 (all parts), *Thermoplastics pipes — Longitudinal reversion*

ISO 2507-1, *Thermoplastics pipes and fittings — Vicat softening temperature — Part 1: General test method*

ISO 2507-2, *Thermoplastics pipes and fittings — Vicat softening temperature — Part 2: Test conditions for unplasticized poly(vinyl chloride) (PVC-U) or chlorinated poly(vinyl chloride) (PVC-C) pipes and fittings and for high impact resistance poly(vinyl chloride) (PVC-HI) pipes*

ISO 9852, *Unplasticized poly(vinyl chloride) (PVC-U) pipes — Dichloromethane resistance at specified temperature (DCMT) — Test method*

## 3 Terms and definitions

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

### 3.1 bell

receiving shape at one end of a section of pipe that serves as a watertight seal when the spigot end of an adjoining pipe section is inserted into the bell

### 3.2 bevel

smoothed annular and angular area at the end of the spigot for assisting in the coupling of the bell and spigot joint

**3.3 dichloromethane resistance**  
resistance following exposure to dichloromethane in order to give an indication of the level of gelation in the pipe and of the uniformity of that gelation

**3.4 gate**  
adjustable opening in the pipe which allows water to be released

**3.5 impact strength**  
measure of the brittleness or the toughness of a material

**3.6 longitudinal reversion**  
change in length of a pipe under higher-than-ambient temperature estimated by subjecting a test portion of pipe immersed in an inert liquid maintained at a temperature of 150 °C for a period of time determined by the wall thickness of the pipe

**3.7 low pressure**  
pressure less than 100 kPa

**3.8 nominal pipe diameter**  
reference value for the size of a gated pipe approximately equal to the outside diameter of the pipe, rounded to the nearest millimetre

**3.9 spigot**  
inserting end of a section of pipe in the bell

**3.10 vicat softening temperature**  
temperature at which a standard indenter under a force of 50 N penetrates 1 mm into the surface of a test piece cut from the wall of a pipe while the temperature is raised at a constant rate of 50 °C/h

**3.11 maximum working pressure**  
highest water pressure at the inlet to a gated pipe unit recommended by the manufacturer to ensure proper operation

## 4 Marking

Each pipe shall bear clear and permanent markings, including the following:

- a) name of manufacturer or registered trademark of the manufacturer;
- b) classification code of the material;
- c) nominal diameter;
- d) reference to this International Standard (i.e. ISO 16149);
- e) production code — compound, extruder, year, month, day, shift.

## 5 Specifications

### 5.1 General

The product in conformance with this International Standard shall have specifications according to 5.2 to 5.4.

### 5.2 Dimensions

#### 5.2.1 Outside diameter

The outside diameter and corresponding tolerances shall be in accordance with Table 1.

**Table 1 — Outside diameters and corresponding tolerances**

Dimensions in millimetres

Nominal diameter $d_n$	Outside diameter $d_o$	Tolerance
50	50	+ 0,3
75	75	+ 0,4
100	100	+ 0,4
125	125	+ 0,5
160	160	+ 0,5
200	200	+ 0,6
250	250	+ 0,8
315	315	+ 0,9
Other diameters may be manufactured by agreement between user and manufacturer.		

#### 5.2.2 Wall thickness

The minimum wall thickness shall be 2,2 mm or the result of the following equation, whichever is the greater:

$$t = \frac{d_o P}{2S + P}$$

where

$t$  is the minimum wall thickness in millimetres (mm);

$P$  is the pressure in kilopascals (kPa);

$S$  is the design stress in kilopascals (kPa);

$d_o$  is the outside diameter, in millimetres (mm).

The wall thickness tolerance shall be + 12 % or 0,8 mm, whichever is the greater.

The dimensions shall be measured according to 8.1.

**5.3 Mechanics**

**5.3.1 Resistance to impact**

Select the point of impact to allow for gate stability during the test. The gated pipe shall not break or fracture, nor shall the gate separate from the pipe, when tested according to 8.2.

The test impact force shall be in accordance with Table 2.

**Table 2 — Test impact force**

Nominal diameter $d_n$ mm	Impact energy	
	N · m	kg · m
50	40	4
75	40	4
160	50	5
200	50	5
250	60	6
315	60	6

NOTE For practical purposes, 1 kg force is equal to 10 N.

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**5.3.2 Resistance to crushing**

A pipe with gates shall show no breaks, splits or cracks and the gates shall not separate or have permanent distortion when crushed according to 8.3.

**5.3.3 Resistance to accelerated aging (weathering)**

The pipes shall have no cracks, bubbles or other defects that could affect their properties when tested under the conditions according to 8.4.

**5.3.4 Watertightness of the joint and of the gate**

Test the assembled joints for joint tightness at a pressure of 250 kPa for a period of at least 15 min, under the conditions according to 8.5. No joint leakage shall occur.

**5.4 Physics and chemistry**

**5.4.1 Resistance to dichloromethane**

When tested in accordance with 8.6, the tested pipe wall shall resist attack in 100 % of internal and external surfaces and in the bevelled area.

**5.4.2 Longitudinal reversion**

When the pipe is tested in accordance with 8.7, the specimen length variation shall be < 5 %. The test section shall show no bubbles, fissures or opaque areas, or other noticeable defects.

**5.4.3 Vicat softening temperature**

When the pipe is tested in accordance with 8.8, the Vicat softening temperature shall be > 80 °C.



## 6 Flow rate of gates

The test flow rate through the gates at the test pressure recommended by the manufacturer shall not vary by more than + 10 % of that specified by the manufacturer, measured in accordance with 8.9.

NOTE This specification is applicable to pipes subjected to a pressure higher than the atmospheric pressure.

## 7 Sampling and acceptance number

See Table 3.

Table 3 — Acceptance number

Clause/subclause of this International Standard	Test	Number of test specimens	Acceptance number
4	Marking	13	0
5.1	Dimensions	13	0
5.3.1	Resistance to impact	5	0
5.3.2	Resistance to crushing	5	0
5.3.3	Resistance to accelerated aging	5	0
5.3.4	Watertightness of the joint and the gate	5	0
5.4.1	Resistance to dichloromethane	5	0
5.4.2	Longitudinal reversion	5	0
5.4.3	Vicat softening temperature	5	0
6	Flow rate of gates	13	0

## 8 Tests

### 8.1 Measurement of dimensions

#### 8.1.1 General

The precision required in each measurement is 0,025 mm.

#### 8.1.2 Wall thickness

Measure the wall thickness using a micrometer with ball anvil or other measuring instrument having the same precision.

#### 8.1.3 Outside diameter

Ensure that the outside diameter is measured with a slide calliper and the readings rounded off to the nearest 0,1 mm. Take measurements around the same cross-section, perpendicular to the pipe axis, rotating the callipers in the plane of this cross-section until the maximum and minimum values are found.