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**Agricultural irrigation equipment — Guideline on the implementation of pressurized irrigation systems — Part 2: Drip irrigation**

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CH-1214 Vernier, Geneva  
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~~Fax: +41 22 749 09 47~~

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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](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, 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 [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

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

A list of all parts in the ISO 24120 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

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## Introduction

Dwindling vital natural resources, such as land and water, and rising world population, pose a constant threat that can develop into a future food and water crisis. Given the limited availability of water and land resources, the amount of food grown today needs to be increased to meet the demands of tomorrow. Reduction of available water for human consumption needs to be addressed. As direct consumption of fresh water by populations cannot be decreased, the amount of water consumed by agricultural uses needs to be reduced and allocated for domestic or industrial use.

Drip irrigation addresses water scarcity and other environmental considerations. Its use can save large amounts of water (over 50-% of water can be saved for certain crop types) and increase yields.

Drip irrigation not only addresses the need to reduce water consumption and increase yield, but also requires less labour and energy for operation, leading to lower costs to farmers due to reduced usage of labour, fertilizers and other chemicals.

Drip irrigation relates to sustainability agriculture issues, and can be used in dry areas, in saline soil with saline water, and in steep-sloped topographies, where other irrigation methods cannot be practiced without using pressure compensated units.

Drip irrigation is easy to handle and operate once installed. It is suitable for automation and remote operation by computer or mobile phone. The system's simplicity makes it easy to install, operate, maintain and repair.

Other than irrigation, the drip irrigation method is used as a delivery system for fertilizers and other agrochemicals. Drip irrigation's advantage as a delivery system is its ability to optimize fertilizer usage, and distribute it exactly where needed, in the root zone, while minimizing its release to the environment.

Adoption of drip irrigation can help achieve sufficient fresh water availability for domestic use and sufficient food quantity and quality and quality for reasonable pricing, while increasing farmers' income with yield increases and cost reduction, and ensuring food security.

Drip irrigation systems also have limitations mainly related to high investment costs and extensive maintenance requirements necessary to achieve and maintain the irrigation system performance. Maintenance routines include water filtration, field inspection, maintenance of driplines, main line flushing, and chemical water treatment.

The purpose of this document is to provide a guideline on the implementation of drip irrigation.

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# Irrigation and drainage equipment and systems — Guideline on the implementation of pressurized irrigation systems — Part 2: Drip irrigation

## 1 Scope

This document provides a guideline for the implementation of pressurized drip irrigation systems.

It is applicable to both small-scale family agriculture and large-scale commercial agriculture, in open fields or within enclosed growing structures (e.g. greenhouse, net house).

This document is intended for the use of agriculture ministries, agronomists, irrigation planners, farmers and other end-users.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

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

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 3.1

#### **anti-siphon dripper**

#### **anti-siphon emitter**

*dripper* (3.3) with an interior mechanism which prevents suction of pollutants from outside the dripper line

### 3.2

#### **chemigation**

application of any chemical through an irrigation system

### 3.3

#### **emitter**

#### **dripper**

device fitted to an irrigation lateral and intended to discharge water in the form of drops or continuous flow at flow rates not exceeding 24 l/h, except during flushing

[SOURCE: ISO 9261:2004, 3.1]

**3.4**

**fertigation**

injection of soluble fertilizers into the irrigation system together with irrigation water

**3.5**

**on-line emitter**

**on-line dripper**

emitter intended for installation in the wall of an irrigation lateral, either directly or indirectly by means such as tubing

[SOURCE: ISO 9261:2004, 3.3]

**3.6**

**regulated emitter~~r~~**

**emitting pipe**

pressure compensating emitter/emitting pipe

emitter/emitting pipe which maintains a relatively constant flow rate at varying water pressures at the emitter/emitting pipe inlet within the limits specified by the manufacturer

[SOURCE: ISO 9261:2004, 3.7]

**3.7**

**regulated non-leakage dripper**

**compensated non-leakage (CNL)**

emitter/emitting pipe whose flow is zero whenever the pressure at the inlet of the emitter/emitting pipe is lower than a value (other than zero) declared by the manufacturer

[SOURCE: ISO 9261:2004, 3.9, modified — Term name has been changed.]

**3.8**

**unregulated dripper**

non-pressure compensating emitter

emitter/emitting pipe whose flow rate varies with inlet water pressure

[SOURCE: ISO 9261:2004, 3.10]

## **4 Principles of drip irrigation**

### **4.1 General**

This document relies on the main principles of drip irrigation as set forth in ISO/IWA 20 and ISO 9261.

The main principles of drip irrigation are described in ISO 24120-1.

### **4.2 Water sources**

The main types of water sources for drip irrigation are:

- surface water sources,
- groundwater sources,

- brackish water,
- treated wastewater (TTW), and
- desalinated water.

Many existing and potential water supply sources for irrigation systems are derived from surface water, which does not tend to have high levels of salts (with the exception of some coastal areas), and thus the irrigation systems are usually less prone to formation of precipitates in drippers when using a surface water source.

Some surface water sources, however, tend to introduce biological hazards, as well as silt. If TWW is considered as a source, quality and clogging potential will vary depending upon the extent of treatment.

Groundwater is generally of higher quality than surface water. However, iron, manganese, hydrogen sulfide, pH, soluble salts, hardness, and alkalinity levels should be measured, as levels that are higher than values determined as acceptable irrigation water quality can lead to dripper clogging and treatment can be required.

### 4.3 Water distribution network

#### 4.3.1 Main line, sub-main, distribution pipes

Main lines carry water through the entire irrigation system, from the pump through the filters, valves and drippers.

All main line and fittings should be properly sized to withstand maximum static and operating pressures and convey water without excessive pressure loss or gain.

PVC piping may be used throughout the system, or in combination with steel piping at the pump station. Polyethylene (PE) or flexible pipes may be used for sub-mains and distribution pipes. PE and PVC piping should be UV protected or buried. Pipes from other materials are permitted if they comply with local requirements.

Thermal expansion and contraction that occur under normal on-surface operating conditions should be taken into consideration (each type of pipe material is affected to a different degree), when designing and installing the system.

Main lines are connected to one another with welds, glue or friction fittings, according to the type of piping in use, and are anchored to the infrastructure supporting them. All main lines should be properly secured and anchored.

In a subsurface drip irrigation (SDI) system, the main line is more difficult to access and repair. All fittings should be secured at installation, to save significant repair issues later. After the initial growth stage of the crop, on-going maintenance should be implemented.

In irrigation design, pipe sizes are specified based on water quality and water velocity, economic considerations, friction loss, water hammer considerations and flushing concerns. As pipe size increases, friction loss decreases (with reduced pumping cost) but initial cost increases.

If water quality is poor, particularly in wastewater, the designer should consider increasing the water velocity in mains and submains to avoid sedimentation in the pipes. In most cases, the distribution pipe is installed above the elevation of the dripper lines.

Irregular field shapes are common due to topography and property boundaries. At the planning stage, care should be taken to properly size sub-main and distribution lines where field shape varies. Sub-main and distribution lines for irregularly shaped fields are designed based on actual flow rates of the dripper lines.

The piping system should be designed not only to allow the flow rate necessary for normal irrigation but also to allow sufficient flow rate for proper flushing velocities in the system (recommended minimum: 1 m/s).

Design objectives for drip system flushing can result in the selection of different pipe diameters than those selected in the design process for normal operation. This is because the flushing flow rate required for achieving a desired flushing velocity in any section of a main, sub-main or distribution pipe can be different than the design flow rate for regular operation.

#### **4.3.2 Drip irrigation laterals (dripper lines)**

Dripper lines are the heart of a drip irrigation system. In any irrigation system, the design process starts at the last plant and proceeds to the head system.

In the design of a dripper line, the following should be considered: dripper line selection, wall thickness, diameter, nominal pressure, dripper flow rate, spacing between drippers, spacing between dripper lines, and specification of dripper line insertion depth (in SDI).

#### **4.3.3 Weather conditions**

##### **4.3.3.1 General**

For surface and subsurface main pipe, attention should be given to two operating conditions listed in 4.3.3.2 and 4.3.3.3.

##### **4.3.3.2 High temperature areas**

The operating temperatures recommended by the manufacturer should not be exceeded. The manufacturer's responsibility normally applies to the pipe and all its connectors.

##### **4.3.3.3 Low temperature area**

In countries where temperatures in winter can be below 0 °C, water should be drained from the pipes of any irrigation system and dripper lines, to protect the main and submain pipes.

## **5 Drippers classification**

### **5.1 General**

Drippers incorporated at uniform spacing along the dripper line deliver water and nutrients directly to the plant root zone.

A typical drip irrigation system includes thousands of drippers. Each dripper should be durable, resistant to clogging, and emit the same amount of water under the same conditions and over time. Good design of the emitter can increase its long-term trouble-free performance.

The flow rate, working pressure and spacing of the drippers should be considered in determining the wetting pattern and to prevent runoff or deep percolation.