Aquadrop®

DRIP TAPE

MADE IN ITALY

PLASTIC-PUGLIA
Irrigation Systems since 1967

USER AND MAINTENANCE MANUAL

value for water

CONTENTS

CHAPTER 1 INTRODUCTION AND PRODUCT FEATURES

The **Aquadrop** drip line, manufactured from high-quality black polyethylene, incorporates a flat turbulent-flow emitter engineered for maximum reliability. Its exclusive dual protection system ensures a high level of clogging resistance: the **Active** system shields suspended particles, while the turbulent **labyrinth** design prevents the formation of internal deposits.

The range includes three emitter configurations: **NANO** (ultra-compact), ideal for maximizing distribution uniformity over long run lengths with minimal head loss; **MICRO** (short), offering an optimal balance between compactness and versatility; and **MEGA** (long, also available in the **XR** version with copper oxide), designed to ensure maximum precision in drip irrigation professional systems.

Aquadrop is therefore an ideal solution for drip irrigation in open fields, greenhouses, and DIY applications. It is a drip line designed for a wide range of horticultural and floricultural crops, ensuring high efficiency and water savings. Its versatility also makes it suitable for landscaping applications, including gardens, hedges, and terraces.

The range is available in different diameters and flow rates. Thanks to variable wall thicknesses for single or multi-season use, as well as customizable emitter spacing, **Aquadrop** can be adapted to any agronomic requirement.

Product quality is certified by **IIP** in full compliance with **UNI EN ISO 9261:2015**.

CERTIFIED PRODUCT
UNI iiP UNI
UNI EN ISO 9261:2015

SCAN THE QR CODE TO VIEW THE TECHNICAL FEATURES

Aquadrop® NANO

1.1 TECHNICAL FEATURES

*for a duration of approximately thirty minutes with open end

Wall thickness	Max working pressure		Max flushing pressure*	
	D/16 mm	D/22 mm	D/16 mm	D/22 mm
6 mil (0,15 mm)	0,80 bar	-	1,00 bar	-
7 mil (0,18 mm)	-	0,80 bar	-	1,00 bar
8 mil (0,20 mm)	1,00 bar	0,90 bar	1,20 bar	1,10 bar
10 mil (0,25 mm)	1,20 bar	1,10 bar	1,40 bar	1,30 bar

PRESSURE-FLOW RATE RELATION

Tests carried out on 10 mil thickness with water at 20°C

Nominal flow rate l/h	Pressure				Recommended filtration mesh/micron
	0,60 bar	0,80 bar	1,00 bar	1,20 bar	
0,60	0,46 **l/h**	0,54 **l/h**	**0,60 l/h**	0,67 **l/h**	150 / 100
0,80	0,61 **l/h**	0,76 **l/h**	**0,80 l/h**	0,94 **l/h**	150 / 100
1,10	0,82 **l/h**	0,99 **l/h**	**1,10 l/h**	1,24 **l/h**	150 / 100
1,60	1,17 **l/h**	1,47 **l/h**	**1,60 l/h**	1,78 **l/h**	120 / 130
2,00	1,47 **l/h**	1,82 **l/h**	**2,00 l/h**	2,22 **l/h**	120 / 130

SCAN THE QR CODE TO VIEW THE TECHNICAL FEATURES

Aquadrop® MICRO

1.2 TECHNICAL FEATURES

*for a duration of approximately thirty minutes with open end

Wall thickness	Max working pressure		Max flushing pressure*	
	D/16 mm	D/22 mm	D/16 mm	D/22 mm
6 mil (0,15 mm)	0,80 bar	-	1,00 bar	-
7 mil (0,18 mm)	-	0,80 bar	-	1,00 bar
8 mil (0,20 mm)	1,00 bar	0,90 bar	1,20 bar	1,10 bar
10 mil (0,25 mm)	1,20 bar	1,10 bar	1,40 bar	1,30 bar

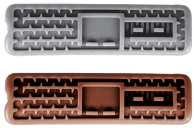
PRESSURE-FLOW RATE RELATION

Tests carried out on 10 mil thickness with water at 20°C

Nominal flow rate l/h	Pressure				Recommended filtration mesh/micron
	0,60 bar	0,80 bar	1,00 bar	1,20 bar	
1,30	0,96 l/h	1,15 l/h	**1,35 l/h**	1,50 l/h	120 / 130
1,60	1,15 l/h	1,45 l/h	**1,65 l/h**	1,90 l/h	120 / 130
2,10	1,50 l/h	1,80 l/h	**2,10 l/h**	2,30 l/h	120 / 130
4,50	3,30 l/h	3,90 l/h	**4,50 l/h**	4,80 l/h	120 / 130

SCAN THE QR CODE TO VIEW THE TECHNICAL FEATURES

Aquadrop® MEGA



Aquadrop® XR
with copper oxide

1.3 TECHNICAL FEATURES

*for a duration of approximately thirty minutes with open end

Wall thickness	Max working pressure			Max flushing pressure*		
	D/16 mm	D/22 mm	D/29 mm	D/16 mm	D/22 mm	D/29 mm
8 mil (0,20 mm)	1,00 bar	0,90 bar	-	1,20 bar	1,10 bar	-
10 mil (0,25 mm)	1,20 bar	1,10 bar	0,90 bar	1,40 bar	1,30 bar	1,10 bar
12 mil (0,30 mm)	1,40 bar	1,30 bar	1,10 bar	1,60 bar	1,50 bar	1,30 bar
15 mil (0,38 mm)	1,60 bar	1,50 bar	-	1,80 bar	1,70 bar	-
18 mil (0,45 mm)	1,80 bar	1,70 bar	-	2,00 bar	1,90 bar	-

PRESSURE-FLOW RATE RELATION

Tests carried out on 10 mil thickness with water at 20°C

Nominal flow rate l/h	Pressure				Recommended filtration mesh/micron
	0,60 bar	0,80 bar	1,00 bar	1,20 bar	
0,80	0,60 l/h	0,70 l/h	**0,80 l/h**	0,90 l/h	150 / 100
1,10	0,70 l/h	0,90 l/h	**1,15 l/h**	1,25 l/h	150 / 100
1,30	0,90 l/h	1,10 l/h	**1,35 l/h**	1,50 l/h	120 / 130
1,45	1,00 l/h	1,25 l/h	**1,47 l/h**	1,68 l/h	120 / 130
1,60	1,10 l/h	1,40 l/h	**1,60 l/h**	1,85 l/h	120 / 130
2,10	1,55 l/h	1,90 l/h	**2,15 l/h**	2,35 l/h	120 / 130
3,80	2,65 l/h	3,25 l/h	**3,85 l/h**	4,15 l/h	120 / 130

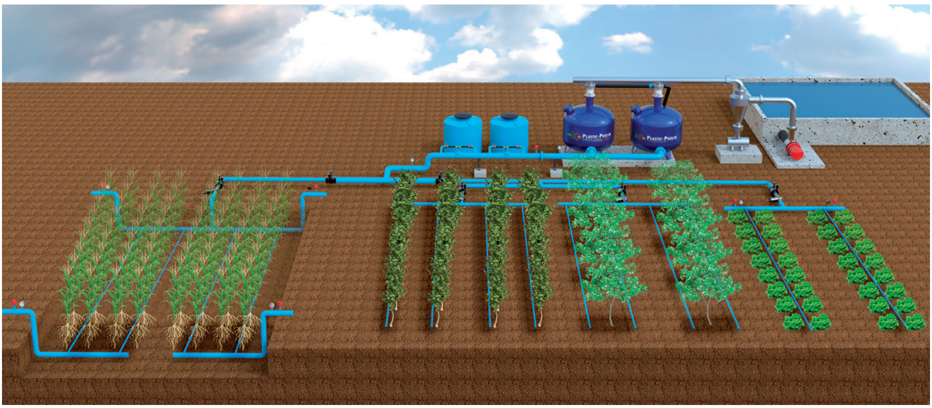
CHAPTER 2 IRRIGATION SYSTEM DESIGN AND ANALYSIS

This manual provides essential technical guidelines for the correct installation and operation of the **Aquadrop** drip line, manufactured by **Plastic-Puglia**.

Proper installation, carried out in accordance with sound hydraulic design criteria and respecting the dimensional and functional specifications of all components, is essential to ensure hydraulic efficiency, distribution uniformity, system longevity, and reduced maintenance costs.

Each phase - from preliminary water quality assessment to system start-up and performance testing - has a direct and measurable impact on the overall performance of the irrigation system.

The instructions provided herein must be considered an integral part of the installation process and used as a structured operational reference to prevent malfunctions, pressure imbalances, and premature material degradation.



2.1 Water analysis

Water analysis is the first fundamental step in the installation of a drip irrigation system. A preliminary assessment of the physical, chemical, and biological properties of the water enables proper system design and helps prevent operational issues that may arise over time.

It is essential to **determine** the presence of suspended solids such as sand, silt, and clay, organic matter, algae, and microorganisms, as well as key chemical parameters including salinity, total dissolved solids (TDS), hardness, iron and manganese content, and pH. The combined evaluation of these parameters allows estimation of the clogging potential—physical, chemical, or biological.

These data **determine** the selection of the **filtration system**, **emitter type**, **components**, and any required **chemical treatment**. Inadequately analyzed water may lead to **frequent clogging**, reduced flow rate, loss of irrigation uniformity, and progressive system performance decline.

Special attention must be paid to iron and manganese, which tend to precipitate in the presence of oxygen, forming deposits that are difficult to remove through standard flushing procedures.

Similarly, high water hardness promotes scale formation inside emitters, progressively reducing flow passages and altering nominal discharge. Water analysis must be performed prior to installation and repeated periodically. Certified laboratories are recommended to ensure reliable and comparable results.

2.2 Pumping system

The pumping system must be properly sized to deliver the required flow rate at the operating pressure specified by the hydraulic design.

The pump must operate within its optimal efficiency curve, ensuring energy efficiency, operational continuity, and pressure stability even under variable load conditions.

Excessive pressure may damage the drip line and system components, accelerating wear, while insufficient pressure compromises water distribution and uniformity across the field.

The installation of surge protection devices and anti-water hammer systems is strongly recommended, as transient overpressure events can damage pipelines and fittings.

2.3 Filtration unit

The filtration unit is a critical component in any drip irrigation system.

Its function is to remove solid particles from the water before they reach the emitters, preventing clogging and preserving nominal flow rate.

The filtration degree must be compatible with the minimum internal flow passages of the emitters and with the water quality determined during analysis.

Screen, disc, or media filters must be selected according to water characteristics and maintained in full operating condition through automatic backflushing or scheduled manual cleaning.

Inadequate filtration is one of the primary causes of reduced system lifespan and loss of distribution uniformity.

2.4 Fertigation equipment

Fertigation equipment allows controlled injection of fertilizers and maintenance chemicals directly into the irrigation water. These systems must be installed downstream of the main filtration unit, with an additional safety filter to protect the emitters.

Only fully soluble products that are chemically compatible with each other and with the water quality should be used.

Improper fertigation practices may cause chemical precipitation, internal scaling, and reduction of **flow paths** within the drip line.

At the end of each fertigation cycle, the system must be thoroughly flushed with clean water to remove any residual chemicals.

2.5 Control valves

Control valves regulate flow rate and pressure within the system, ensuring stable operating conditions consistent with the design specifications. In simple systems, manual shut-off valves may be sufficient, whereas more complex installations require pressure-regulating and flow-control valves.

Main valves control flow from the pump to the filtration unit and field distribution. In some configurations, temporarily reducing field flow improves filter backflush efficiency. Zone valves enable independent management of irrigation blocks, optimizing irrigation scheduling.

Flush valves, installed at the end of pipelines, facilitate periodic removal of sediments. Increasingly, these functions are managed by automated valves integrated with irrigation controllers.

2.6 Air and vacuum relief valves (AVR)

Air and Vacuum Relief valves (**AVR**) prevent negative pressure within pipelines, which may cause soil particles to be sucked into the system, leading to emitter clogging, particularly in subsurface installations or sandy soils.

Installed at high points and manifolds ends, AVR valves allow controlled air release during filling, air intake during draining, and the elimination of trapped air pockets.

2.7 Main and submain pipelines

Main and submain pipelines convey water from the source to the drip line and must be properly sized to minimize friction losses and ensure uniform distribution.

Before connecting the drip line, all pipelines must be thoroughly flushed and pressure-tested to remove debris and verify system integrity.

CHAPTER 3 INSTALLATION AND MECHANICAL LAYING

The **Aquadrop** drip line delivers water directly to the crop root zone.

Selection must be based on crop type, soil characteristics, water quality, and expected system lifespan. During design, maximum run length, emitter spacing, and nominal flow rate must be strictly observed.

Proper system sizing ensures uniform water distribution and maximum irrigation efficiency.

Emitter outlet orientation must be correct to prevent soil particle intrusion, particularly in subsurface installations.

In **Aquadrop**, the co-extruded **blue stripe** identifies the side that must face upwards during installation. This ensures correct emitter orientation, protecting against clogging and guaranteeing long-term performance.

3.1 Pressure parameters and system integrity

Maintaining operating pressure within manufacturer specifications is essential for system durability.

Exceeding recommended limits subjects the drip line to mechanical stress, causing deformation, rupture, and irregular emitter discharge. Conversely, insufficient pressure prevents the turbulent labyrinth from operating correctly.

Summary table of pressure effects

Pressure condition	Effect on drip tape	Impact on flow delivery
Above the specified limits	Deformation and ruptures	Irregular emitter discharge
Below the specified limits	Labyrinth channels fail to activate	Poor distribution uniformity
Excessive run length	High friction losses	Flow imbalance between inlet and distal end

3.2 Run length and head loss management

System design must strictly comply with the maximum allowable run length for each drip line model.

Excessive length results in friction losses, leading to significant flow variation between the beginning and end of the line.

This hydraulic imbalance causes non-uniform irrigation, with higher discharge near the inlet and lower discharge at the end of the row.

3.3 Positioning relative to roots and soil

The drip line must be placed near the root zone at a distance depending on soil type and root development. Correct positioning ensures water reaches the roots efficiently, minimizing evaporation and deep percolation losses.

In subsurface installations, burial depth must allow proper wetting of the root zone.

3.4 Installation guidelines

Before installation, a proper irrigation system design must be completed.

A filtration system between 100 and 150 mesh must be installed depending on emitter type and water quality.

Aquadrop operates at low pressure; therefore, appropriate pressure regulation devices are required.

In sloped or subsurface installations, **check valves** must be installed to prevent water hammer, and **air intake valves** must be used to avoid vacuum conditions.

Coils must remain protected with their wrapping film until installation.

3.5 Mechanical installation

Place the **Aquadrop** coil on the laying equipment, securing it with metal or wooden discs tightly fitted against the cardboard flanges. Ensure the reel rotates freely on its axis.

Maintain a minimum distance of 60–70 cm between the bottom of the coil and the entry point into the laying tube.

Use a steel or PVC guide pipe (40–50 mm diameter) with a smooth internal surface and wide curvature radius to prevent abrasion. Inspect all equipment carefully and remove any sharp edges.

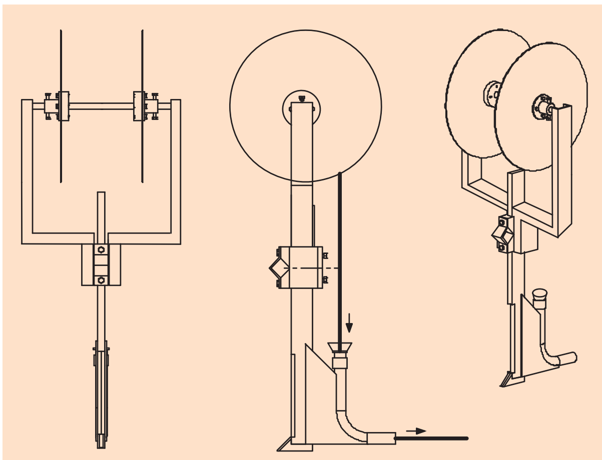
The inlet of the guide pipe must be flared, and the outlet must be **duck-bill-shaped** to maintain correct tape orientation.

The drip line must be installed with the **blue stripe facing** upward to reduce sediment accumulation at the emitter inlet.

Installation must be carried out carefully.

The tape should be guided manually to avoid excessive tension that could deform the material.

Ensure the tape does not rub directly against the ground before placement and continuously check for cuts, abrasions, or kinks.



CHAPTER 4 START-UP AND MAINTENANCE

All main and submain lines shall be thoroughly flushed before Aquadrop drip line installation.

After connecting the **drip line**, leave the line ends open to allow complete removal of impurities. Close the line ends and **gradually pressurize the system**, avoiding **water hammer**.

Operate progressively by slowly opening control valves until the required operating pressure is reached.

Regular maintenance is essential to ensure efficient system performance. Filters must be cleaned frequently during the irrigation season and inspected after any prolonged shutdown.

Only high-quality, fully **water-soluble fertilizers** should be used to prevent precipitation and emitter clogging.

Periodic verification of flow rate and distribution uniformity along the lines allows early detection of clogging issues. Lines must be flushed regularly, particularly after each fertigation cycle.

(!) **Aquadrop** must not be installed under transparent plastic mulch film, to avoid burning caused by the concentration of solar rays which, passing through condensation droplets, create a lens effect. If mulch film is required, use only opaque or shading films certified for surface and subsurface irrigation.

Keep reels in their protective film until the moment of installation to prevent attack by rodents, insects, and other pests.

The drip line may be covered with soil in order to:

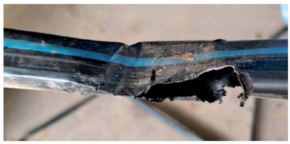
- prevent displacement due to wind
- protect against damage caused by field traffic or rodents
- reduce thermal expansion due to temperature variations
- minimize surface evaporation
- improve fertilizer efficiency by delivering nutrients directly to the root zone
- reduce the development of fungal diseases and weeds
- protect against UV exposure and extend product lifespan

Drip tapes are sensitive components and may be damaged by multiple factors, including installation and cultivation machinery, insects, birds, rodents, and excessive operating pressure.

Examples of damage that may occur

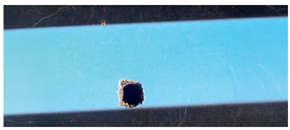
▲ Lens effect

▲ Root intrusion



▲ Rodent damage

▲ Insect damage



▲ Wireworm and millipede attack

▲ Bird damage

▲ Tool damage

▲ Excessive pressure

CHAPTER 5 TROUBLESHOOTING GUIDELINES

Promptly recognizing anomaly signals is fundamental to preserving the longterm performance of the drip irrigation system.

The main factors capable of reducing or compromising regular operation are suspended matter, chemical precipitation, biological growth, and root intrusion. The following table shows the most common problems - detectable through flow rate and pressure variations - together with their possible causes.

Problem diagnosis by system area

Component	Detected anomaly	Possible causes
Filters	Excessive pressure drop	Debris / Inadequate backflushing Blockage
Flush valves and end caps	Particles or debris in discharge water	Broken filter element / Fertiliser precipitation / Bacterial growth
Pump	Abnormal flow rate and pressure	Leaks in distribution system Open or closed valves / Malfunction
Filters	Gradual decrease in flow rate	Emitter clogging / Pump wear
Valves	Sudden change in flow rate	Jammed valve Water supply failure
Mainlines	Sudden change in pressure	Damaged pipeline Regulator failure
Pumping station	Motor or storage anomalies	Insufficient maintenance Obsolete system
Overall system	Discolouration / Leaks Crop stress	Minerals / Fertilisers / Algae Pests / Over-pressure
Emitters	Gradual increase in flow rate or pressure	Pest damage / Clogging

5.1 Organic clogging

Organic contaminants such as algae, fungi, bacteria, larvae, and insects—typically present in surface water sources—require specific treatment.

System flushing with sodium hypochlorite (5% chlorine concentration) or hydrogen peroxide is recommended. Using the following formula, the required quantity for a flushing treatment can be determined. For routine maintenance, inject chlorine at 10-20 ppm for approximately one hour.

$$q = \frac{C1 \times P}{Co \times 10}$$

q= quantity of hypochlorite to be diluted
C1= 10 to 20 ppm
P= irrigation system flow rate (m3/h)
Co= concentration of hypochlorite (5% chlorine)

For example: in a system with a flow rate P = 10 m3/h, the quantity to be injected will be:

$$q = \frac{20 \times 10}{5 \times 10} = 4 \text{ lt of product}$$

Since chlorine may be phytotoxic, it is necessary to reduce concentration while increasing contact time. Alternatively, hydrogen peroxide (130 volumes) may be used at a dosage of 3-4 liters per cubic meter of water. Fill the system, shut it down, and allow the solution to act for at least one hour. Flush thoroughly and repeat if necessary

5.2 Mineral clogging

Mineral particles such as sand, silt, and clay must be removed through proper filtration systems.

Filtration represents the primary protection for the system and requires regular maintenance, with increased frequency when water quality deteriorates.

The filtration degree must be compatible with the minimum internal flow passages of the emitters.

Unfiltered particles may cause progressive clogging.

Hydrocyclones are recommended when water contains high levels of sand and dense particles, such as in well or canal water. They use centrifugal force to separate heavy particles, which settle in a collection chamber and must be periodically removed.

However, hydrocyclones are ineffective against fine or low-density particles.

Media (sand) filters are suitable when water contains both inorganic and organic suspended matter or when turbidity is high and variable. These filters consist of tanks filled with silica sand or quartz media, providing filtration through physical and electrostatic mechanisms.

Disc or screen filters provide fine filtration and are typically used as a final stage downstream of hydrocyclones or media filters.

Maintenance.

Inspect the system during backflush cycles at least every two weeks, ensuring pressure levels are within specifications before and after cleaning. Check valves, differential pressure switches, and controllers. Clean control filters and verify media levels at the end of the season.

In frost-prone areas, completely drain filters and control systems to prevent damage.

5.3 Chemical Clogging

Chemical clogging is caused by precipitation of dissolved minerals such as **calcium**, **magnesium**, **iron** and **manganese**.

At high concentrations and at **pH levels exceeding 7**, these elements tend to form deposits that restrict or block flow passages.

Iron can be identified by reddish discoloration, while hydrogen sulfide may reduce calcium carbonate precipitation due to its acidic properties.

A simple field test for carbonate deposits consists of applying vinegar: effervescence indicates dissolution of calcium or magnesium deposits. Fertilizers may also contribute to clogging. Compatibility testing is recommended by mixing fertilizer with irrigation water at working concentration and observing for precipitation after 12 hours in a dark environment.

Treatment

First perform organic cleaning to remove biofilms. Then inject nitric, phosphoric, or sulfuric acid at a 0.2% concentration (2–3 liters per cubic meter) for 45-60 minutes.

Flush thoroughly with clean water after treatment.

Caution: to prevent hazardous chemical reactions, always add acid to water—never the reverse. After using the acid solution, restore soil by amending with nitrogen, phosphorus and sulfur-based fertilizers.

5.4 Root intrusion

Roots naturally grow toward moisture and may penetrate emitters, causing severe clogging.

The most effective preventive measure is maintaining consistent soil moisture. Frequent, short irrigation cycles are preferable to infrequent, high -volume applications.

Periodic acid injection (**nitric or citric acid**) helps control root intrusion and dissolve mineral deposits.

For minor intrusion, **acidifying** the irrigation water to a very low pH (below 4, comparable to concentrated vinegar) is sufficient to eliminate small roots.

For severe cases, more aggressive treatments may be required, including **high-concentration chlorine** (100–400 ppm), **phosphoric acid** or **Metam sodium**.

Hydrogen peroxide, injected in diluted solution, allows microroots to be eliminated without damaging system components.

For line sanitation, use chlorinated water at 30–50 ppm. Carry out a complete terminal flush at least midseason and at the end of the season to remove silt, organic residues, and root fragments.

In the **Plastic-Puglia** range, **Aquadrop** is also available in the **XR** version, featuring **copper oxide** in the emitter, which prevents root intrusion without releasing chemicals into the soil.

CHAPTER 6 DISPOSAL

Polyethylene (PE) drip lines, once the cropping cycle is completed, must be treated as **non-hazardous agricultural waste**.

They are not part of municipal waste collection and must be disposed of through **authorized agricultural waste management systems**, in compliance with environmental regulations.

Removal must be carried out before plowing to prevent **fragmentation** and soil contamination. After collection, tapes should be cleaned of soil and plant residues, then rolled into compact bundles for transport.

Disposal must be carried out at **authorized facilities.** Recovered polyethylene is recycled into new plastic products, reducing environmental impact.

6.1 Prohibited practices

It is strictly **prohibited to burn drip lines** in the field: polyethylene combustion releases harmful substances and is punishable by law. Burial, abandonment along field edges, or disposal with household waste must also be avoided—practices that may result in penalties, potential criminal liability, and direct environmental damage.

CHAPTER 7 PRODUCT WARRANTY

Aquadrop is warranted against manufacturing defects and non-conformities arising from the raw materials used. The warranty period is **proportional** to the **wall thickness** of the product and subject to the operating conditions specified in this manual.

The quality of **Aquadrop** has been tested by several international institutes, obtaining various certifications and excellent results that place it among the best products on the market. Aquadrop is **I.I.P** certified in accordance with **UNI EN ISO 9261:2015**.

Each production batch undergoes **internal quality controls** to ensure consistent performance. To be valid, any warranty claim must be submitted in writing within eight (8) days of receipt of the goods. The claim must be accompanied by a defective sample clearly showing the production codes.

Products confirmed by Plastic-Puglia as defective must be returned at the buyer's expense, in accordance with the supplier's instructions. Plastic-Puglia's liability is limited to **replacement** with a similar product of equivalent value.

Claims will not be accepted for products that have **been tampered with**, **improperly installed**, **or used** in a **manner inconsistent** with the instructions in this manual.

The manufacturer shall not be liable for any costs incurred by the buyer for installation, removal, and/or replacement of the product, nor for loss of profit or any other direct or indirect, foreseeable or unforeseeable damage.

7.1 The warranty is void if:

1. The system is not equipped with pressure regulators capable of ensuring the operating values specified in the technical data sheet
2. Aquadrop drip line is installed under transparent mulch film
3. Chemical products or fertilisers are used at concentrations higher than those specified in the technical manual.
4. The **filtration system** does not comply with the values prescribed on the **Aquadrop** label.
5. The emitter filter or labyrinth channel is **obstructed** by foreign matter.
6. Installation and/or system design has not been carried out to a professional standard or with suitable means, in accordance with the instructions in this manual.
7. The product shows any type of tearing and/or abrasion resulting from negligence during installation or from damage caused by insects, rodents, agricultural machinery, or similar factors occurring during operation.

7.2 Contact Information

Registered office and production facility
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