



INSTALLATION AND MAINTENANCE OF IRRIGATION SYSTEM

NAANDANJAIN

A JAIN IRRIGATION COMPANY

INTRODUCTION

Thank you for choosing to work with us! We have provided this short guide to help you operate your system for the longest period of time and with the best possible results. Please read it carefully before installing your system.

NaanDanJain's uniqueness lies in its ability to provide optimum agro-technical solutions, effectively tailored to meet specific needs.

NaanDanJain's professional team of agronomists, design engineers and irrigation technicians has designed and installed a large number of turnkey projects worldwide.

The team adapts technologies to provide customers with solutions for the most challenging topographical, climatic, soil and water conditions.

The company's reputation as a leader in the irrigation market is based on a vast knowledge of hydraulics, water analysis, water distribution and agricultural applications.

If you have any questions, please don't hesitate to contact us at:

Phone: +972-8-9442180

Fax: +972-8-9442190

Company website: www.naandanjain.com



INSTALLATION

1. Avoid any mechanical damage

When you receive the equipment and set it up in the field, do your best to avoid damaging it. Take care not to drive over the pipes when they are being unrolled.

2. Match the design map to the field

Compare the actual field dimensions, topography, number and length of rows with those in the irrigation plan. If modifications are required, they should include additional hydraulic calculations.

3. Head control assembly

Make sure you have a detailed design of the head control assembly. You may need a concrete contractor, plumber and electrician to complete the job.

4. Installing main pipelines

PVC main pipeline (>110 mm) must be at least 1.0 m deep (measured at the top of the pipe when it is in the ground) so that the trench is 1.1-1.5 m deep. If the temperature in the area falls below zero degrees, install the main pipe at a depth of 1.5 m to protect it. The backfill should be stone-free. If the soil is sandy, cover the trench after laying every 20 m. It is recommended to cover the pipe every few meters before the final cover.

5. Installing sub-main pipelines

Deploy the sub-main in its feature location. Prepare the trenches. Their location and depth should comply with the plan and specifications. The recommended depth for PE pipes is 50 cm. The recommended depth for PVC pipes (sub-main only) is 70 cm.

Distribute pipe sections along the trenches.

Make sure the backfill is stone-free.

Try to avoid leaving the trenches open overnight. If you must leave trenches open, cover the pipe every few meters and at every outlet when the pipe is inside the trench. If there are chances of rain at night, avoid leaving the trenches open at all costs.

6. Flushing head control, main and sub-mains

Flush the head and pipes thoroughly, until the tailwater is clear. Be sure to flush out all plastic and rubber cuttings, grit, stones, etc. It is recommended to flush just before the installation of the laterals.

Connect the laterals to the sub-mains as soon as possible to prevent the intrusion of insects and dirt.

Flush the laterals thoroughly until the tail water is clear, then immediately install the end plugs.

Note: Flush the laterals in small groups to ensure full flow. Start flushing from upstream (start with the laterals closest to the head) and proceed downstream. Plug the lateral ends in the same order.

Note: Do not leave pipes or connector outlets open for more than a few hours so that no dust or insects enter the system.

7. New plantations

In new plantations, the accurate positioning of the drippers beside the plant is vital in the first 2 to 3 months. Anchoring the lateral edge with a rubber string is a simple procedure.



8. Start-up

Check the recommended working pressures for the system. Any deviation from the allowed working pressures may cause dysfunction of the system. Check the approved chemicals for the system (see table on page 8). It is highly recommended to do water analysis for the main mineral components: Ph, EC, Carbonates (CO_3), Bicarbonate (HCO_3), Calcium (Ca), Magnesium (Mg), Sodium (Na), Sulfate (SO_4^{-2}), Phosphate (PO_4), Iron (Fe), Manganese (Mn), TSS, TDS and water hardness.

Follow the installation and operation manual supplied by the filter manufacturer.

Start the newly-installed filtration system and flush it thoroughly. Wash out the dust and debris from

the filters. Use manual operation mode to flush the automatic screen/disc filters.

Make sure that the correct valves are open and that all sub-mains and lateral ends are closed. Do not apply excessive pressure. Methodically, start and check one irrigation block at a time.

Compare the designed pressures at different points to the actual pressure.

Evaluate dripper operation by checking the formation of the wetted areas around them.

Note: It is recommended to log the initial flow rates and pressures at certain points. Maintaining a log book is very useful in helping you to detect changes and potential problems.



FILTRATION

The filter is the heart of the irrigation system and should therefore receive frequent attention.

The filtration system should protect the irrigation system from clogging and erosion of components, and should be designed according to the water source and the type of irrigation system installed in the field. The recommended filtration level is expressed in Microns or in Mesh, and is dependent on the type of emitter used. The required filtration levels are specified in the product catalog pages of the drippers, micro-sprinklers and sprinklers. If there are no recommendations for the emitter you are using, use a filtration level 5 times smaller for sprinklers and 10 times smaller for drippers than the nozzle/outlet of the emitter.

Note: The most important trait of a filter is its effective filtration area—not just the filter size!

Installation and Start-up (Filters)

Main filtration heads and automatic filters

Install filters and filtration systems according to the manufacturer's operation and installation manual. Pay special attention to diameter and length of the drain tubes—follow the manufacturer's specifications.

General instructions for start-up and the beginning of each season

Ensure that all the electrical connections and hydraulic command tubes are in working order.

Install new batteries (for backflush controller).

The system's controller DPI should be adjusted to flushing at ΔP of 0.5 bar (7 psi) as a default.

Set the controller to flush according to ΔP , as well as to flush according to time.

The common interval is 1-3 hours. Interval is dependent on water quality.

Before the first operation, do a few flushing cycles to wash dirt and debris from the system.

For media filters:

- Ensure the media level meets the manufacturer's specifications. Ensure the media is clean and loose. Ensure the media type corresponds to the manufacturer's specifications.
- During backflush, make sure the backflush flow

meets the manufacturer's specifications, and that no media is flushed out of the tanks. Adjust the flow control valve if needed.

- Perform chlorination before the start of the season, according to manufacturer's instructions.
- Replace the media every 2 years. Follow manufacturer's instructions for media replacement.

Main filtration heads and automatic filters

Verify that the differential pressure does not exceed 0.5 bar (7 psi).

Check the intervals between flushes. If the interval is less than 1 hour for gravel filter and less than 15 minutes for screen and disc filters, this may indicate that the dirt load is too heavy for the system or that the backflush is ineffective. Follow manufacturer's instructions to correct the problem.

General maintenance (filters)

Follow manufacturer's operation and installation manual for detailed maintenance instructions.

Minimum pressure required for automatic or media filtration is at least 30 m.



VALVES

Back-up filters

Check and clean back-up filters at least once a week, preferably after every irrigation cycle. Check for any damage to the screen element or deformation of the discs in disc filters.

Note that clogged back-up filters may indicate a problem in the main filtration station.

Clean screen filters with a soft brush. Do not use a metal wire brush.

Clean the disc filters by releasing the discs inside the element and washing the discs. Do not release the discs all the way. This will prevent them from coming loose.

If the discs have accumulated carbonate sediments, you may need to clean with acid. Follow the manufacturer's instructions for cleaning.

Preparation for the off-season (filters)

Drain all filters.

Check the interior components, media, screens and discs for wear, damage, corrosion and other signs of deterioration.

Check seals, gaskets and valve seats for wear.

Lubricate bolts and axles. Paint or renew damaged protective coating.

Disconnect irrigation controller power source or batteries.

Check the electrical wire and hydraulic command tubing for damage.

Service the filtration system and valves, according to the manufacturer's recommendations.



The control valves enable automatic operation of the irrigation system, as well as regulation of pressures according to the hydraulic design.

Start-up

Verify that the tubes and control components are undamaged before opening the water.

Connect the solenoid's electric wires and pressure tubes, according to the design.

For pressure-reducing valves, release the pilot adjustment screw all the way before opening the water, and then slowly tighten it until the pressure reaches the required level. This will prevent high pressure damage caused by inadequate pilot set-point at first operation.

Note that the valves might be pre-adjusted, according to the hydraulic design.

Verify that the pressure levels at the various valves correspond to the hydraulic design. Adjust, if necessary.

Winterization

In areas subject to low winter temperatures (below 0° Celsius), it is vital to drain the water from the system to prevent water from freezing inside and breaking the components.

Make sure that there is no water left in the valves, control chamber, tubes, pumps, filters and air valves. When water freezes inside the system, it increases its volume while turning into ice, and therefore breaks any system component that contains it!



LAY-FLAT HOSE

Lay-flat is an optimal solution for open fields and may replace PE, PVC or metal pipe as an on-the-surface line.

Never bury lay-flat hose in the ground!

When the pipe is full with water, do not drive over it!

Installation

Insert the connector into the hose. After the connector is inserted all the way into the hose, tighten the hose to the connector with 2 narrow metal bands or one wide band. For sub-main LF with a dripline outlet, the operating pressure is reduced. Check the recommended maximum pressure.



PVC PIPE

Check that the grade of the PVC pipe match the designed pressure of the system.

Check if a rubber gasket is required.

Do not cover PVC with concrete!



MAINTENANCE FOR DRIP IRRIGATION

Acid treatment

Application of acid is recommended as part of a routine maintenance procedure. Acid injection reduces clogging caused by low solubility salts, such as calcium carbonate.

The following recommendations are for hydrochloric acid 33% or phosphoric acid 85%.

Determining the acid quantity to be injected:

Take a 10 liter bucket and gradually start adding acid in small portions and measuring the accepted pH. Once you reach the required pH of 2.0, calculate the amount of acid required for receiving this value in your system. Multiply the acid quantity by 100 and inject this amount per 1 m³ of the system discharge.

IMPORTANT

While preparing the acid solution Always add the acid to the water and not vice versa.

Treatment instructions:

1. Treatment should be carried out 1-2 times during the irrigation season, or when system discharge drops by 5%



2. Flush all submains and laterals before starting the treatment
3. Check the discharge of the system before the treatment in order to later compare this with the discharge of the treated system
4. Solution preparation: The solution volume (water + acid) should be equal to one quarter (1/4) of the hourly discharge of the injector. This way the injection will last for 15 minutes. We recommend working with the maximum injector discharge in order to avoid working with a highly concentrated solution

5. Start the injection only after the system is full of water and the drippers are emitting
6. Control: Using a litmus indicator strip, check the pH at the furthest lateral for residual acid (pH 2.0). A second test is recommended if no residual acid is detected
7. Inject for 15 minutes.
8. Continue irrigation for 30-60 minutes to ensure the complete flushing of the system
9. Check the discharge of the system

Example:

Acid required for pH (2.0) in the 10 liter bucket = 12 cc
 12 cc X 100 = 1200 cc = 1.2 liters
 Inject 1.2 liters of acid per 1 m³ of the system discharge.
 System discharge (of the treated sector) = 30 m³/h
 System discharge during the 15 minute treatment = 7.5 m³-
 Acid required = 1.2 liter X 7.5 = 9 liters
 Max. injector discharge = 200 l/h
 Total solution volume required (1/4 of 200 liters) = 50 liters
 50 liters of solution = 9 liters of acid + 41 liters of water
 Injection time = 15 minutes (50 liters injected with a 200 l/h injector)

Lateral flushing

Lateral flushing is the most important maintenance practice. Flush the laterals before and after each irrigation season. It is recommended to flush laterals periodically throughout the season depending on water quality. Lateral flushing flushes out debris that accumulates in the dripline, which can eventually clog the dripper's water inlet. Flushing is done by opening the lateral end for 1-2 minutes until the water that comes out of the lateral is clear. Installing a lateral flush valve will reduce costs of manual labor and guarantees frequent flushing. High-pressure head and flow velocity of flushing are important factors in removing sediments. For best results, use the highest operating pressure allowed. Recommended minimum flushing velocities:
 Mainline: 1 m/s
 Sub-main: 1 m/s
 Laterals: 0.6 m/s or 16mm - 400l/hr, 20mm - 700l/hr at 1.0 bar at edge of dripline

Chlorination

Chlorine injection reduces clogging caused by organic materials. It is recommended as an intermittent treatment or as an ongoing preventive treatment in systems that use water that contains a high concentration of organic materials. The most commonly used material is sodium hypochlorite 10-12%.

Treatment instructions:

1. Find out the required dose, treatment frequency and longevity. Refer to the chart below:

Application method	Residual free chlorine concentration (PPM)		Treatment frequency	Duration (hr)
	At point of injection	At end of lateral		
Continuous	3-5	1.0	Every irrigation	Through all the irrigation time or at the last hour of the irrigation
Intermittent	5-10	1.0	Whenever needed, according to water quality	1.0 hour

Water at pH above 7.5 reduce the chlorination effectiveness. Acidified to a pH of 6.5 will maximize the effectiveness of the chlorine treatment

Contact Time:

A minimum contact time of 30 min. is required for the effective chlorine treatment in order to kill the microorganism. This time is measured from the moment you detect free chlorine in the emitters.

Concentration of free chlorine

Measure active free chlorine concentration (residual chlorine), using a color comparison set. This is the same set that is used to monitor the chlorine levels in swimming pools. The residual chlorine concentration depends on the water chlorine demand.

2. Flush all submains and laterals before starting the treatment.

$$\frac{(\text{System discharge m}^3/\text{h}) \times (\text{chlorine concentration PPM at injection point})}{(\text{Concentration of the stock solution \%}) \times (10)} = \frac{(\text{Injector discharge l/h})}{10}$$

3. Dosing and injecting: Use the following formula to determine the injection rate and stock solution concentration.

If the injector can be manipulated to inject at different discharge levels, you may do so, according to your requirements. If not, you can adapt the stock solution concentration.

Adapting the stock solution concentration to a fixed injection rate:

Example:

- System discharge (of the treated sector) = 30 m³/h
- Chlorine quantity required: 10ppm*30 m³/hr/10%/10= 3.0 liter
- Chlorine concentration required at injection point = 10 PPM
- Injector discharge = 200 l/h
- Solution preparation: Mix the 3.0 liter with 197 liter of water. This volume will be injected now in 1.0 hr at 10ppm of chlorine

Warning:

Active Chlorine is dangerous. Follow the manufacture instruction.

Storage:

Sodium hypochlorite should be stored under a shaded area in a clean dark tank ,without any fertilizers residues. Concentration will degrade over time.



Table 1: Chemicals that CAN be injected in drip irrigation systems

Nitrogen	Urea, Ammonium Nitrate, Nitrate acid
Phosphorus	Phosphorus acid, Monoammonium Phosphate, Ammonium Phosphate
Potassium	Potassium Nitrate, Potassium Chloride
Micro-elements	Chelates and Boric acid

Note: Chemicals must be 100% soluble in order to be injected into the drip system!

Table 2: Chemicals that MUST NOT be injected in drip irrigation systems

DO NOT USE:
Polyphosphate
Red Potassium Chloride
Red Potassium Sulphate
Borax
Organic products with high contents of suspended solids
Fertilizers or products with low solubility
Waxy chemicals, oil solvents, petroleum products and detergents
Active Chlorine with more than 25 ppm (This limitation only applies to PC drippers. There is no limitation for non PC drippers.)
Acid solution with a pH lower than 2

Safety measures

- Only use acid-resistant containers for the cleaning process.
- Use adequate body protection in order to prevent any direct contact with the acid solution.
- Purchase the acid only from official suppliers. Use the acid according to their official MSDS (material safety data sheet).
- Tapered connection must be unassembled before the acid cleaning treatment.
- The cleaning solution is Hydrochloric acid (HCl), diluted with water.

Note that the acid should be poured into the water.

Plugs

When using plugs for drip irrigation, installation must be done under water pressure—when the drip lines are full. It is highly recommended to first check the plugs on a few drippers to make sure that the plugs fit the dripper and that there are no leaks.



MAINTENANCE FOR MICRO-SPRINKLERS & FOGGERS

NaanDanJain micro-sprinklers should be installed and operated according to the recommendations in the relevant catalogs.

Find the filtration requirements for your specific product in the NDJ catalog or NDJ web catalog (NaanDanJain.com > web catalog).

NaanDanJain products should operate for a long period of time. However, with time, lime deposits might occur. This document will guide you on how to remove it.

Flow Rate Check

Once a year, perform a random check of a few micro-sprinklers at the recommended working pressures, and compare the actual flow rate in the field to the values that appear in the catalog, including the permitted tolerance.

Non-regulated micro sprinklers:

1. Low flow rates – may indicate possible clogging in the nozzle, at the entrance to the micro-sprinkler and in the filters, so these should be checked.
2. High flow rates – may indicate wear and tear in the nozzle, which should then be replaced.

Regulated micro-sprinklers:

1. Low flow rates – may indicate possible clogging in the nozzle, at the entrance to the micro-sprinkler and in the filters, so these should be checked.
2. High flow rates
 - 2.1 Open the micro-sprinkler to verify that the disk is in place and positioned freely. Clean the disk and wash the area, and then perform another flow rate check.
 - 2.2 If the flow rate remains higher than the permitted maximal rate, it may indicate a decrease in the quality of the disk, which must then be replaced.

Cleaning instructions for removing lime deposits

Safety measures:

Only use acid-resistant containers for the cleaning process.

Use adequate body protection in order to prevent any direct contact with the acid solution.

Purchase the acid only from official suppliers. Use the acid according to their official MSDS (material safety data sheet).

Tapered connection must be unassembled before the acid cleaning treatment.

The cleaning solution is water, diluted with hydrochloric acid (HCl). Note that the acid should be poured into the water.

Dilution example:

Hydrochloric acid at 32 % concentration

Recommended treatment concentration: 0.2%

Concentration of the solution: $(0.2:32) \times 1000 = 6.25$

This means that 6.25 milliliters of acid are diluted in 1 liter of water.

Cleaning process

The micro-sprinklers/foggers should be immersed in the solution for 3 hours and then properly washed with water. The process can be repeated up to 4 times (a maximum of 12 hours) if the first cleaning cycle did not clean the sprinklers perfectly.

Warning: You can damage the micro-sprinklers with a high concentration of acid. Make sure to follow the instructions exactly, or first try on small number of micro-sprinklers.



MAINTENANCE FOR SPRINKLERS

Basic operation guidelines

Avoid irrigation in windy conditions and do not irrigate when wind speed is higher than 2 m/s.

Check that you are working at the recommended pressures.

Verify that you are using the appropriate sprinkler and stand.

Make sure the sprinkler is installed about 60 cm above the crop.

Make sure that all stands/risers are vertical.

To prevent water run-off, match the duration of irrigation and the precipitation rate to your soil.

Make sure all nozzles are clean and free of dirt or any other particles that may affect performance.

Preventing wear and tear

Check and tear seals and gaskets, and replace if necessary.

Check and tear nozzles, and replace if necessary.

Every 0.2 mm increase in the diameter of the nozzle orifice (due to wear and tear) contributes to a 10% increase in flow rate. This fact may reduce distribution uniformity and have a negative effect on pump operation.

Filtration:

Read the filtration requirements written in the NDJ catalog or NDJ web catalog (NaanDanJain.com > web catalog) for your specific product.

The recommendation filtration level refers to the nozzle size. The ratio between the nozzle diameter and the filtration degree is 1:5. For example, if the nozzle size is 5 mm, the filter holes should be maximum 1 mm.

In wells or sources of water that are rich with sand, it is highly recommended to install a sand separator—hydro-cyclone or automatic filter. Sand will cause fast wear and tear of the nozzles and may cause the sprinkler to leak.

Never use oil or grease to lubricate sprinklers that bear washers.



WARRANTY

NaanDanJain products are guaranteed on a parts-only basis against defects in workmanship and material under normal use and service for a period of 12 (twelve) months from the date of original invoice, when installed and operated in accordance with NaanDanJain's specifications. This Warranty is provided on an exclusive basis to authorised NaanDanJain dealers only and NaanDanJain shall bear no liability to any other purchaser or end-user.

NaanDanJain's sole responsibility under this Warranty shall be, at its own discretion, either to repair or replace any component or part which fails during this period, provided that NaanDanJain has been notified of the failure in writing by the authorized NaanDanJain dealer within 30 (thirty) days of failure, and provided that the part is defective in material or workmanship. Inadequate or inappropriate use, maintenance, application, installation or filtering, and/or improper or unauthorized use of products in conjunction with NaanDanJain products shall cause this Warranty to be null and void.

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Warranty Claim notice should be sent to:
NaanDanJain Irrigation Ltd.
Head Office: Post Naan 76829
ISRAEL





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