Netafim
Micro Irrigation System

Operation and Maintenance Guidelines

2003

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Introduction

All systems have common elements or operating components although the layout and size of different systems will vary. Plenty of information is available, and we suggest you place all relevant segments of information together in one binder eg “Netafim Irrigation System – Operation and Maintenance Manual”. This 3 ring binder has dividers which accommodates information on

General
Pumps
Filters
Controller
Fertigation
Valves
Maintenance

Keeping all this information together will undoubtedly assist you to operate your Micro Irrigation system effectively with the minimum of effort.

Maintenance is an important though often overlooked operation to extend not only the trouble free life of the system itself but to maximise returns on your investment. Preventative rather than corrective maintenance is more economical and less traumatic. A little planning goes a long way!

1. Preventative Maintenance

1.1 Water Source

Check Mainline pressure. Nominal Pressure: in metres
Check along various points of the mainline

1.2 Filtration System

Check Pressure at the filter output. Nominal Pressure: in metres

The frequency of maintenance will vary with water quality. Periodic service and maintenance of these filters, is required to ensure continuous trouble free operation. Section 2.1 describes the recommended maintenance program for the filters. Refer also to manufacturers' specific instructions

1.3 System Pressure

Check pressure at the ends of the laterals

Pressures should be as per the Irrigation System Design.

Check submain pressures

Check at the front end of the system, near the submain, to ensure that the pressure does not exceed the maximum recommended pressure for the drip line.
Max Pressure for DL2000 = 30 m (300kPa)

1.4 System Flow

Check flow rate during each shift

Record the flow occurring over a fixed period of time, via the water meter. The flow should be recorded as either litres per second (l/sec), or cubic metres per hour (1 m^3/Hr = 1 KL/Hr). When checking the flow rate of your system, ensure that the system is operating and fully pressurised.
Measurements taken under normal system operation will become your reference point and are very useful later on in identifying problems.

Example: To get a reading in litres per second and cubic metres per hour:

1) Record the starting water meter reading eg. 13339.1 KL.
2) Record the reading after 6 minutes eg. 13343.4 KL.
3) Amount of water flowed is 13343.4 – 13339.1 = 4.3 KL
4) Flow rate per hour = 4.3 KL x 10 = 43 KL/Hr or 43 m^3/Hr
5) Flow rate per second = 4.3 KL / (6min x 60sec) = 4300 / 360 = 11.9 l/sec

Note: the longer the time between start and finish readings, the more accurate your flow figure will be.

1.4.1 Interpreting Flow variations

Changes in the flow rate of a system can be an indication of problems.

Increased flow can be a result of:
Leaks in the pipe work,
The system pressure is to high (in non-pressure compensated systems),
A Valve opening incorrectly or out of sequence,
One or more valves not closing at the end of irrigation (ruptured valve diaphragm, mechanical fault with the valve, or corroded solenoid plunger, on automated systems).

Decreased flow can be the caused by:
Partially or completely blocked drippers,
Blocked check filters,
Blocked main filter,
Blocked pump suction (foot valve).

1.5 Check Plants.

Inspect plants and pipework

Visually inspect plants on a regular basis and look for sign of stress.
Also, when possible, check the wetting point and pattern. Look for areas where dispersion is not uniform or that differs greatly from the pattern at other drippers. Look carefully for any signs of leaks.

1.6 Valves.

Check remote operation of field valves

Valves in the irrigation system should be checked, to make sure they are operating correctly, both in manual and remote mode. Each valve should be opened and closed a number of times.
Check the pressure setting of the regulators.

1.6.1 Pilots

Annual Maintenance:
Disassemble pilot valve assembly,
Lubricate shaft and O-rings with Silicon grease,
Clean out any silt build-up.
Check diaphragms

1.6.2 Valves

Annual Maintenance:
Remove and clean finger filters on the valve body.
Check wiring connections
Remove weeds and rubbish from the valve area

1.7 Controller

Check for correct Controller operation

Operate each shift in turn from the controller. Only the valves, which are programmed to run, should irrigate. After running a shift for several minutes, turn OFF the shift, and start the next shift. Check that the all the valves from the previous shift are turned OFF and the valves from the current shift are operating.

1.7.1 Diagnosing cable faults eg (Motorola systems)

If you have a problem with a valve which will not operate through the controller, but operate manually:

Check for correct voltage at the piccolo. On the A.C range of a multimeter , the voltage should read 40V, +/- 10%,
If there is no voltage at the Piccolo, you may have a broken wire (open circuit) between the controller and the valve. If you had any repair work on pipes, or any other digging on your vineyard, this should be the first place to look for the problem. If you need to repair one or more of the cut wires:
Dig back along the control cable either side of the break until you have uncovered enough wire to run up to an end assembly above ground level,
Run a new length of wire in the trench and up to the two end assemblies,
Install a waterproof junction box on the end assemblies and terminate the wires with suitable joiners.

REMEMBER: All repairs must be brought above ground. This maintains reliability and makes subsequent fault-finding easier.

2 Automatic Filtration Systems

CAUTION:
Never open an automatic filter until the system has been turned off and pressure in the system has been released by opening a gate valve. If you fail to take this precaution, you could injure yourself and damage the filters.

2.1 Preventative Maintenance

2.1.1 Weekly:

Check pressures on filter input and output,
Look for and correct any leakage from the filters,
Check for correct operation of the backflush controller,
Check and clean the filter feeding the command tubes.

2.1.2 Monthly:

Check solenoids and backflush valves,
Check system pressure downstream of the filters,
Visually inspect each filter and the manifolding to ensure all are in satisfactory condition,
Flushing controller: check the voltage on the lead acid battery. Should be > 10.6 V. If lower, remove and re-charge.

2.1.3 Seasonal:

Open all filters & check the “O”-rings: replace any that are damaged or show signs of excessive wear,
Lubricate o-rings as they are re-installed,
Check the condition of the filter media (discs, screen, gravel): clean and if necessary, chemical wash.

2.1.4 Winterization:

Empty the command tubes and command water filter feeding them,
Turn off the backflush controller.

> Note: if water is being drawn through the system over winter, do not drain the command tubes. Leave the backflush controller on and continue with routine checks on the system.

2.2 Trouble Shooting

2.2.1 No backflush:

Check & clean command filter,
Check controller is OK: ensure DC or AC power is available. If the backflush controller is battery powered, check the fitted storage batteries are charged and in good condition. If a solar charger is used, ensure the panel is clean and still in a position to catch maximum sunlight,
Check solenoids are OK,

2.2.2 Solenoid leaking:

If water is leaking through the vent outlet on the solenoid, this may be caused by problems in the valve or command filter.

Release the command tube from the solenoid. If water continues to leak from the tube, (ie. coming from the filter), the filter is at fault:
Remove the filter cover,
Check all components in the filter are OK. Replace any damaged components.

If water leaks from the valve only when the command tube is connected, check for problems in the valve:
Remove the valve cover,
Check the condition of the diaphragm & piston. If either are damaged, replace them.

2.2.3 Leakage at booster valve

Check filter OK,
Check valve OK,
Check solenoid is OK,
Check booster valve & replace if needed.

If these checks fail to identify the source of the problem, contact your Netafim Dealer or representative for assistance.

2.3 Cleaning Disc Filters

The discs should be removed from the element (spine) and soaked in an acid solution for up to12-24 hours. Hydrochloric acid, (HCl), obtained from a farm or swimming pool supplier, mixed to 30-40% solution, (3-4 litres of acid mixed with 10 litres of water), will remove any buildup of organic and mineral salts from the grooves in the discs.

After soaking in the acid solution, the discs should be sprayed with high-pressure water, to remove any residual particles or acid. Damaged or buckled disks should be removed and replaced with new discs, (always use the same colour discs to replace damaged ones). Reassemble the discs on the spine.

Clean check and lubricate all “O”-rings and moving parts. Replace any damaged “O”-rings with new ones.

> Note: use only recommended “O”-rings, (“EPDM” normally), and silicon base lubricant grease to lubricate the O-rings. Eg Molycote111

Manually flush the filters at the end of the service, to ensure correct operation of the system.

3 Pipe System Flushing.

Flushing helps prevent dirt accumulating at the end of the pipe work. The interval between flushing depends mainly on the water quality pumped through the system.

How often to Flush:
Flushing programs should start at short intervals. The interval can then be extended according to the system performance - if minimum amount of contaminant present, time between flushing can be extended; if a large amount is found, flush more often. The flushing program interval may also need to be changed at different times of the year according to irrigation frequency and water quality.

3.1 Mainline Flushing.

In general, drip irrigation mainlines, should be flushed at least once a year.
The flushing process should be done in order of distance: starting at the pump end, and moving towards the end of the system.

Important Notes:
System pressure should be kept at maximum while flushing the mainline. You may need to manually open up the pressure reducing/sustaining valve to obtain sufficient flow,
Manually flush (clean) the main filters prior to any system flushing. Disable the backflush controller during flushing. If filter flushing is not disabled, automatic flushing will deny the system of flow and reduce the water available to properly clean the mainline,
Flush the mainline manually, with all irrigation valves closed. Do not flush with any irrigation valves open or you will just wash the dirty material into your emitters.
Start by opening the flushing (scour) valve closest to the pipeline. Dirt will not flush instantly, out of the system, it may take several minutes before dirt starts flowing through the valve. The flushing valve should be closed, only after the majority of the dirt has been flushed out and clean water has flowed from the valve for at least two minutes.

REMEMBER: Always turn **ON** the next scour valve, before turning **OFF** the last valve. If your system only has one scour valve, turn **OFF** the main valve before closing the scour valve at the end of flushing.

3.2 Submain Flushing.

To ensure that any dirt accumulated in the submain is removed before it can enter the laterals, submains should be flushed prior to any lateral flushing,.

Flushing Procedure:

1. Clean the check filter (if fitted).
2. Open the flushing valve at the end of the submain.
3. Open the irrigation valve and flush all dirt out of the submain,

NOTE: Submain flushing can be performed by turning on your normal operating shift at the controller. However, only one submain should be flushed at a time.

3.3 Lateral Flushing.

Check the operation of the automatic flushing valves on the end of laterals. Ensure they are opening and closing properly with the start of each shift.

Once a season, manually flush the laterals.

Laterals should never be flushed without first flushing the submain.

Lateral Flushing Procedure.

1. Ensure submain is flushed.
2. Ensure check filter (if fitted), is clean.
3. Ensure system pressure is set correctly, and the block to be flushed is fully pressurised.
4. Open flushing valve at the end of 5 – 10 laterals (opening of more then 10 laterals at one time can drop the system pressure below the minimum pressure required for flushing). If the system is not fitted with a flushing valve at the end of each lateral (ie. The dripline is folded over), unfold the end of the lines, making sure all kinks are removed from the lines (partially fold lines will greatly reduce the efficiency of the flush for that lateral).
5. Close the open laterals, one at the time, before opening the next laterals. Continue the process to flush all of the laterals.

3.4 Flushing after repairs.

Repair or replacement of any pipe in the system will usually introduce some soil, dirt and plastic shavings into the system.
It is thus recommended that the system be thoroughly flushed after any repair work.

PROCEDURE:

Before the repair:
Isolate the repaired area from the rest of the system by closing the isolation valve in the mainline (if fitted). The isolation valve should be closed, before attempting to repair the line. Care also should be taken to minimise the amount of dirt entering the line while the repair work is carried out.
After the repair:
open the isolation valves, (if fitted), and open the closest scour (flushing) valve, to the point of repair and downstream from the repair point. Close any isolation valve past the flush valve, to prevent movement of dirt downstream, (further down the line).
Start the pump and flush the system to remove all accumulated dirt.

> **Note:** External dirt and debris is usually heavy, it will take some time before this dirt will flush out. Failing to thoroughly flush the mainline, can create problems by continually blocking check filters, and can ultimately lead to blocked drippers.

4 ACID AND CHLORINE TREATMENT

Irrigation systems should be manually inspected before any treatment. Do not proceed until all leaks or damage has been repaired.

Other than sand, silt and clay, the most common causes of clogging are precipitation of calcium carbonate ($CaCO_3$), calcium phosphates compounds, iron oxide (Fe_2O_3), and bacterial slime and algae growths.

Precipitation of calcium, magnesium, or other inorganic matters can be removed by acid treatment. Algal material and slime can be removed with chlorine injection.

4.1 Acid Injection.

Over time, precipitate calcium salts will block the drip emitters. Acid injection is used to dissolve the buildup. Technical acids such as hydrochloric acid, sulphuric acid, nitric acid, and phosphoric acid are suitable.

To achieve effective acid treatment, the pH of the irrigation water has to be reduced to a value of 2 for 10 minutes. Perform a Titration test to evaluate how much acid will achieve this with *your* water. Use a 10 litre bucket and add small increments of acid until the desired pH level is attained – see later explanation.

SAFETY PRECAUTIONS
Acids are poisons and are dangerous to humans.
Before use, read carefully the safety instructions provided by the manufacturer,
Always wear eye protection, gloves and safety clothing when handling acid,
Ensure eyewash bottles and shower facilities are available,
Acids are very corrosive to steel, cement and aluminium pipes. Pipes made of polyethylene and PVC are not effected by acid.

4.1.1 Acid Injection Equipment.

The acid injector should be a fertiliser type injector, capable of injecting concentrated acid directly into the system. A Venturi type injector, connected to a booster pump, or piston pump, can be used. For help selecting the correct injector, contact your local dealer.

Before Treatment.
Cut open a number of emitters. The sample should be taken from low areas and at the end of the laterals away from the water supply.
Inspect the pipe for mineral build up. Check the emitter inlet filter area for blockages.
Check for buildup in the emitter flow path.

It is important at this stage to determine what types of precipitates are accumulating in the system:
Algae or slime are usually black and greasy in appearance,
White precipitates usually indicate carbonates
Rust coloured precipitates are usually irons.

If you are not sure what contaminants are present in your system, seek the advice of your local dealer, or the local water analysis laboratory.

You can test the effect of acid treatment on your system prior to any treatment:
Take ten litres of irrigation water (use the irrigation water only),
Record the pH of the water,
Slowly mix in acid in measured quantities of acid and , whilst monitoring the pH with a pH meter,
Record the quantity of acid required to drop the water pH to 2.0 for later use,
Now, take the emitter sample (the one you cut out of the line) and place it in the solution. The acid should dissolve the minerals in 10 to 20 minutes. If you do not see any effect, on the dripper, acid treatment will not be effective on your system.

ACID CONCENTRATION TABLE

Type of acid	Normal concentration of the specific acid	Recommended concentration in the treated water (Rough Guide)
Hydrochloric (HCL)	33-35%	0.6%
Sulphuric (H_2S0_4)	70%	0.6%
Nitric (HNO_3)	60%	0.6%
Phosphoric (H_3P0_4)	85%	0.6%

Note: Hydrochloric acid is readily available as a treatment agent for swimming pools and because of the lower concentrations is safer to handle. By using the Titration method you could use ¼ to ½ of the 0.6% Rough Guide above!!

Calculation Example: (Rough Guide)

To calculate the amount of acid required, using an example from the table above:

System flowrate 16.67 l/sec (1000 litres/minute)
1000 x 60 = 60,000 litres/hr
Using Hydrochloric acid at 35% concentration
For 0.6% concentration, injection rate required = 60,000 x 0.6% = 360 lit/hr
But, as the acid is supplied at 35% concentration, required amount of acid is 360 / 0.35 = 1028 litres/hr
To inject for 10 minutes require 1028 x (10/60) = 340 litres of acid.

The Titration Method should dramatically cut down on these quantities!

4.1.2 Treatment process.

Determine the required volume of acid to be injected and mix to the required concentration,

> **Note**: always start with a mixing tank filled with the correct amount of water. Then slowly add acid to the water. If done the wrong way, the water will boil off creating a very dangerous situation.

Flush the system,
Commence injecting the acid,
Measure the pH at the farthest lateral from the injection point,
Continue injection for 10 minutes after the pH gets to 2.0,
Flush the system by irrigating for 30 to 60 minutes to remove the remaining acid from the system.

Calculation of time for injection is based on flow velocities of: 1.5-2.0 litre/second in mainlines, 1.0 litre/second in submains and 0.5 litre/second in the drip laterals. It is strongly recommended to inject the acid as close as possible to the treated area and downstream of the irrigation valves. If the acid is injected at the irrigation valve, 10 minutes injection is normally sufficient.

4.2 Chlorine Injection.

Chlorine treatment of irrigation systems protects the system from build up of organic matters such as algae and iron bacteria.
Chlorine is an oxidising agent, which kills bacteria and disintegrates organic matters.
Used at high concentrations, it can prevent build up in pipes and drip emitters.
The most common form of chlorine used for treating micro irrigation systems is Sodium hypochlorite (10% chlorine).
Chlorine treatment intervals will depend largely on water quality. However, it is recommended to chlorinate the system at least once a season, in surface supplied (dam, river), drip systems and as required, for drip systems supplied by bore water, which contain iron bacteria.
Chlorine can be injected at the pumping station. However, if system contaminant is severe in the laterals, injection of chlorine at the irrigation valves is more effective.

> **Remember**: mains, sub mains, and laterals must be flushed prior to the any chlorine treatment.

The chlorine should be injected at a constant rate until free chlorine reading is achieved at the end of the laterals. This can be measured with a swimming pool kit. A fertiliser injector (the same one as used for the acid), can be used.

The required injection rate of chlorine solution is calculated in the following way:

$$q = (C1 \times Q) / (CO \times 10)$$

Where:

q = flow rate of injected chlorine solution (lit/hr)
Q = system flow rate (m^3/h)
CO = concentration of active chlorine injected (%)

C1 = desirable concentration of active chlorine in the water (PPM)

Example:

System flow rate Q = 125 m^3/h
Active chlorine concentration in the solution CO = 10%
Desired concentration of chlorine in the solution Cl = 10 ppm

q = (10 x 125) / (10 x 10)
= 12.5 lit/hr injection rate

In some cases of severe contamination, it may be necessary to inject the chlorine at higher rates.