

N E T A F I M U S A



**SUBSURFACE DRIP IRRIGATION (SDI)
INSTALLATION GUIDELINES**

FOR MINING



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Subsurface Drip Irrigation (SDI)

Installation Steps Summary

1. Mark the location of the sub-mains.
2. Install the drip lines through the total length of the pad. (Where the sub-mains have been marked, lift the shanks out of the ground so the drip lines are exposed at the connection area.)
3. Install the valves, air vents, flow meters and sub-mains on the marked path (step 1).
4. Flush sub-mains (see guidelines).
5. Drill the holes in the sub-mains at the required spacing and taper the holes with the fitting thread size ($\frac{1}{2}$ " or $\frac{3}{4}$ ").
6. Connect the adapters to the tapered hole.
7. Cut the drip tubing and connect it to the adapters.
8. When all the drip lines are connected to the sub-main, start the drip lines flushing process.

Injection of the SDI System for Leaching

Step 1 - General

The injection of drip lines into the ore is a process that must be executed professionally and requires maximum attention and concentration. Unlike surface installation of drip lines, in most cases, defective injection is irreversible.

1.1 Before Starting

Do not start the injection process without following the strict instructions of the project designer and/or the leaching expert regarding:

- Injection equipment
- Injection depth
- Location of various outlets on sub-main lines (flushing valves, vacuum valves, etc.)

1.2 Installation Crew, Tools and Accessories

Installation crew: a leader, a skilled tractor driver and an additional worker.

Injection Equipment: a 100 - 120 HP tractor, assembly injector shank, pipe cutters, rake and short measuring tape (3 meters).

Required accessories: box of connectors for the drip lines, signal flags, and in case of breakage - several injection shanks and sheering bolts - to replace bolts affixing the shank to the frame.

1.3 Required Work Rate

The tractor should travel at a speed of 4 miles per hour, driving approximately 20 miles per day; hence, the injection rate should be approximately 750,000 square feet per day.

Step 2 - Preparation for Drip Line Injection

- 2.1 Verify the length of drip line - there should be enough for an entire field:
 - For a tape injector using small drums (such as Minelite), three drums should be sufficient.
 - For drip lines supplied in coils (such as Leachline X), several additional coils must be available on the tape injector. This will enable a smooth injection process once the drip line coil has been used and terminated.
- 2.2 The brakes of the assembly tape injector (SDI injector shanking tool) should be adjusted to enable free rotation of the drums (or coils) and to stop drum rotation when the tractor stops.
- 2.3 The depth wheels of the assembly tape injector (SDI injector shanking tool) should be calibrated to the required depth, both before and during the injection process.

Injection of the SDI System for Leaching, *con't*

Step 3 - Injection

- 3.1 The starting point for drip line injection should be several meters before the edge of the pad, and the ending point should be several meters after the end of the pad. This will ensure drip line injection to the specific depth required.
- 3.2 At the beginning of the injection process, the tractor should be driven slow enough that the additional worker can walk with the tractor and hold the drip line in his hand. After approximately 3 to 4 meters, the worker should jump onto the back of the tractor to inspect the injection process and handle any problems that may arise (such as drip line coil replacement on the drum).
- 3.3 The worker should occasionally check that there is no protrusion (flange) at the end of the feeder pipe that may groove the entire length of the injected drip line.

Step 4 - Drum Drip Line Replacement During Injection

- 4.1 The worker, who is sitting at the back of the tractor, is responsible for informing the driver when the drip line is about to end so the driver can gradually slow the tractor down.

Step 4 - Drum Drip Line Replacement During Injection, *con't*

- 4.2 The worker should ensure that the end of the injected drip line passes the roller (a pair of Okolon rolls that stretches the drip line during injection) and when this process is done inform the driver to stop the tractor. Connection of the injected drip line to the new line should be executed using a connector in the space between the roller and the inlet of the feeder pipe.
- 4.3 After assembling the connector, the driver should begin driving, very slowly, until the connector safely exits the feeder pipe. Then, the driver can return to the regular driving speed. To ensure optimum replacement, the worker will manually assist the entry of the connector into the feeder pipe.

Step 5 - Injection Shank Rise and/or Breakage of the Shank's Sheer Bolts

- 5.1 When this occurs, mark the location with a signal flag. Then arrange for a digger and/or worker to detect and resolve the problem (such as removal of a large stone or hard lump of soil). If the sheering bolt is broken the driver can lift the entire assembly tape injector (SDI layer machine) above the ground, and the worker can replace the bolt. The injection process can be restarted.

Flushing After Completion of Installation

Important Note: This includes control head, main lines, sub-mains and drip lines.

Step 1 - General

- 1.1 Purpose
 - To remove dirt particles that have entered the system during installation. Dirt removal is achieved when efficient flushing velocity in the entire system is accomplished.
 - To provide efficient flow velocities a detailed flushing program should be planned for each project by the designer.
- 1.2 Preconditions for execution of system flushing
 - Water source must be able to supply the required flow rate and volume for flushing.
 - Pumping station, system heads and main pipes are assembled and ready for flushing.
- 1.3 Crew and Tools
 - The crew will include the irrigation manager, plus a number of workers, depending on the size of the project. The standard is two (2) workers per block (when all blocks are flushed simultaneously) based on the flushing timetable.
- 1.4 Work Tools and Accessories for the Crew
 - Each worker should have: pipe cutters or cutting knife, a bag with connectors for drip lines and a bag with line end fittings.

Flushing After Completion of Installation, *con't*

Step 2 - Preparing for Flushing of Main Lines

Important Note: *Flushing should strictly be performed based on the flushing timetable supplied by the designer, including all specified stages. DO NOT flush the main, sub-main and drip lines simultaneously.*

- 2.1 Check water availability based on the designed flow rate.
- 2.2 Prepare the crew, vehicle and communication system.
- 2.3 Calculate flushing duration per second.
 - Divide the length of the mainline (m or feet) from the water source to the most distant flushing valve by the average flow velocity of 2.75m/sec (9 feet/sec) and multiply by a factor of five (5). The flushing duration amount should be represented in seconds.
- 2.4 Verify that all valves connected to the sub-main lines are closed (excluding those that may be needed for flushing the mainline).
- 2.5 Close the service valves of the air valves to prevent entry of dirt into the valves.
- 2.6 Post the flushing crew members as required and return to the control head.

Step 3 - Flushing the Mainline

- 3.1 Operate the pump with the main valve closed (the valve that supplies water to the plot).
- 3.2 Gradually turn on the main valve.
- 3.3 Communicate with the crew in the field to receive completion of the specific flushing stage notifications (emission of clean water for the duration defined in item 2.3) or defective functioning if any (leakage, low-flushing velocities etc.).
- 3.4 During the flushing process, check for possible pressure drop in the filtration system and flush it manually, if necessary.
- 3.5 Verify that the water flowing out of the outlets is clean (no mud or foam due to the pipe's lubricant) after a period of three (3) minutes.

Step 4 - Flushing Sub-Main Lines

Important Note: *Do not flush sub-main lines when the drip lines are connected. Connect the drip lines to the sub-main line's blind pipes only once the sub-main lines' flushing has been completed.*

- 4.1 Verify that all plugs or end line valves at the end of the sub-main lines are open throughout the entire system.

Step 4 - Flushing Sub-Main Lines, *con't*

- 4.2 Conduct briefing for the crew regarding the flushing process based on the specific flushing program for sub-main lines and drip lines. If instructions are not provided regarding the flushing duration for each sub-main line, flush each for at least five (5) minutes. In any case, at the end of the flushing duration clean water should exit the system for at least three (3) minutes.
- 4.3 Start the flushing process based on an orderly flushing plan; open and close the valves on the sub-main lines as required. During the flushing process, bypass the pilot using hydraulic valves and pilots (by adjusting the three-way control valve or disconnecting the tube) to create better pressure for flushing (not exceeding 5 at - 70 psi).
- 4.4 At the end of flushing of the entire field, close the flushing valves or the plugs at the end of the sub-main lines.

Step 5 - Flushing Drip Lines

- 5.1 Once all sub-main lines have been flushed and stages A5 and A6 have been completed connect all the drip lines to the outlets on the sub-main lines. This operation requires a large crew.
- 5.2 Verify that all the drip line ends are wide open to enable efficient flushing.
- 5.3 The flushing crew workers should be posted next to the ends of the drip lines (1 to 2 workers per block). The manager is responsible for opening and closing of the valves. Once opened, the manager should drive to the flushing posts and instruct the workers when and where to begin closing line ends.
- 5.4 The crew posted next to drip line ends should measure the amount of time needed for the drip lines to discharge water, at a uniform rate, to the point where the pressure is stabilized. After a few minutes, drip line ends in all the blocks being flushed should be sealed - starting from the drip lines with the strongest flow towards those with the weakest.
- 5.5 Based on the following criteria, the irrigation manager will set the number of minutes devoted to the flushing process:
 - Drip line length of up to 300 feet (100 meters) – 5 minutes
 - Drip line length of 300 to 650 feet (100 to 200 meters) – 10 minutes
 - Drip line length of 650 to 1,000 feet (200 to 300 meters) – 15 minutes