Drip Irrigation Operation and Management

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Drip Irrigation

- Has a long history in Agricultural Applications
- Often promoted as an “Efficient” alternative to sprinkler or flood irrigation methods
- In Truth….
  - “Only as efficient as the person behind the design, installation and management of the system”

Drip Components

Operation and Maintenance

Components of Drip Systems

- Manual or Remote Control Valve
- Drip Products
- Flow Meter
- Pressure Gauges
- Pressure Regulators
- Backflow Prevention Devices
- Screens & Filters
- Flushing Valves
- Injection Equipment

Drip Products

- Drip Products used in Vineyards
  - Drip Tubing
  - Point Source Emitters

Drip Tubing

- Poly Tubing with drip emitters inside the tubing
- Emitter Spacing is set in the manufacturing
    - Common spacing's: 6”, 12”, 18” & 24”
- Limited Emitter Flow Rates
    - Flow Rates Vary from .26 GPH to 1 GPH
- Most often used for buried applications

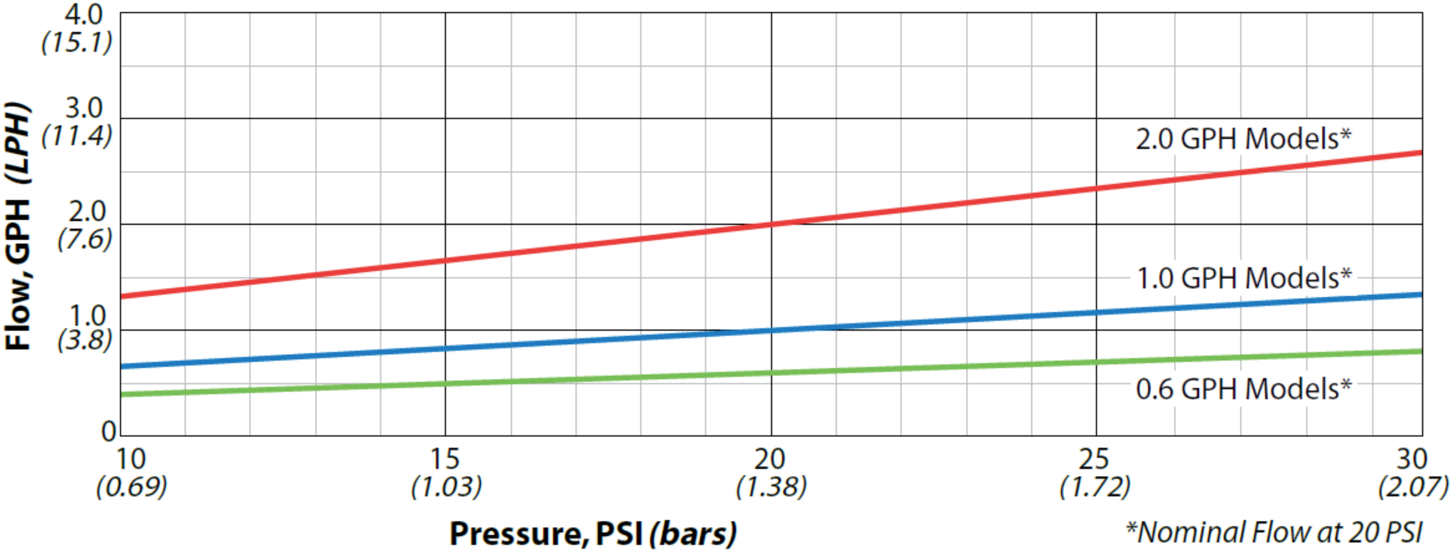
Point Source-Insert Emitters

- Emitters are inserted into a poly tubing at user designed spacing's
- Emitter flow rate can vary from .5 GPH to 24 GPH
- Some emitters are pressure compensating
- Often not rated for direct burial

Drip Specification - Performance

NonStop Drip Emitters

Nominal Performance

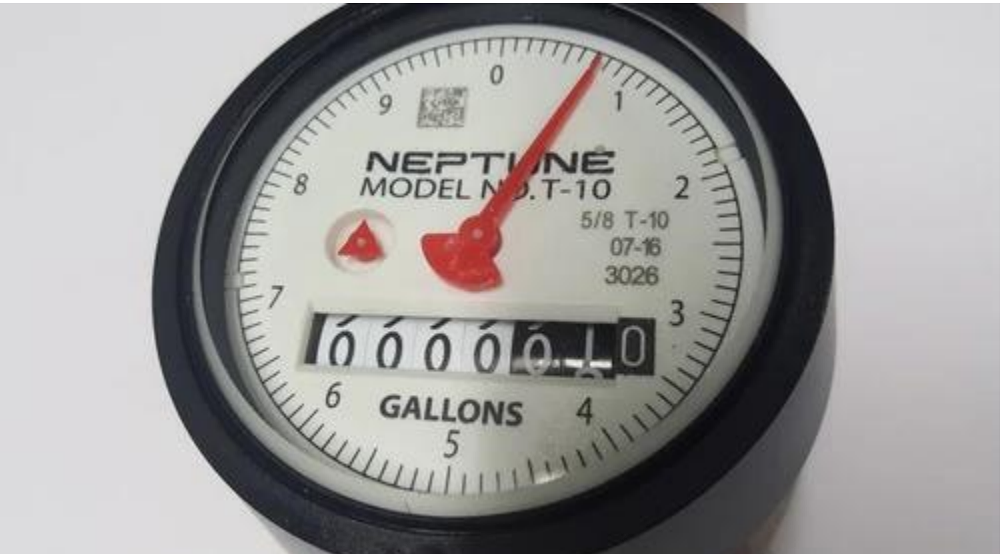


Notes

- 30-mesh filtration and 15 PSI emitter operating pressure are the recommended minimums for a NonStop emitter system.
- Manufacturer's variation, C_V: ≤ 0.05

Flow Meters

- Flow meters help growers monitor water usage
- System flow rates will vary based on design and number/size of emitters
- Knowing flowrates helps: scheduling, maintenance, chemigation, etc.



Pressure Gauges

- Every Irrigation System/Station has a design pressure
- Monitoring pressure helps identify if/when maintenance maybe be needed
- Pressures > Design
  - Clogging Concern?
- Pressure < Design
  - Leak Concerns?

Backflow Prevention Assembly Devices

- Safety device which prevents the flow of water from the irrigation system back to the water source
- Typically required on systems that use potable water, groundwater or chemigation
- 4 Main Types of Backflow Devices
  - Atmospheric Vacuum Breaker – AVB
  - Double Check Assembly – DC
  - Pressure Vacuum Breaker – PVB
  - Reduced Pressure Principle Assembly - RPZ

Backflow Devices

- AVB

- PVB

- DC

- RPZ

Pressure Regulators

- Drip products vary in their pressure requirements
  - 10 PSI to 50 PSI+
- Some systems require pressure regulators to achieve manufacturers recommended pressure requirement
- Some devices have pressure regulators built in
- Often installed after the station valve

Screens & Filters

- Used to catch plastic and sediment in the irrigation water
- Prevent clogging of emitters and valves.
- Should be checked at least seasonally for concerns

Screens & Filters

- Screen filters are used for drip systems connected to municipal water sources and other “clean” water sources such as groundwater
- Sand media filters or disc filters may be required for drip systems connected to surface water (rivers, lakes, ponds, etc.)

Filters

- Drip irrigation systems MUST include a filter
- With groundwater, a screen (mesh) filter is normally satisfactory
- Choose the mesh size of the filter using manufacturer's recommendation for the exact product being used

OPERATING SPECIFICATIONS

- Recommended pressure range: 20 to 50 PSI
- Minimum filtration 150 mesh; 100 microns

OPERATING RANGE

- Pressure: 8.5 to 60 psi (,58 to 4,14 bar)
- Flow rates: 0.6 and 0.9 gph (2,3 l/hr and 3,5 l/hr)
- Temperature:
  Water: Up to 100°F (37,8° C)
  Ambient: Up to 125°F (51,7° C)
- Required Filtration: 120 mesh

Flushing Valves

- When sediment becomes trapped in the drip product, a flushing valve is used to remove it
- Flushing valves can be automatic or manual.

Chemigation Injectors and Pumps

The most common types:

- Mechanical
  - Piston (positive displacement) pumps
  - Diaphragm pumps
- Venturi meters

Piston/Positive Displacement Pumps

- Uses a “piston” to inject chemical into the irrigation water
- Rate is determined by the
  - length of the stroke
  - number of strokes per minutes
- Chemicals come into contact with piston, so materials should be matched to prevent corrosion

Piston/Positive Displacement Pumps

Injection rate remains constant and does not change if the irrigation pipeline pressure varies

- Injection rates cannot be adjusted while operating
- Commonly used to inject fertilizer (large rate injection)

Piston/Positive Displacement Pumps

Diaphragm Pumps

- A membrane separates chemical from the drive mechanism (piston)
- Easy to adjust flow rate while operating
- Commonly used for low-rate injection (pesticides, etc.) or continuous injections (chlorine or acid to lower pH)
- Easy to calibrate and maintain

Diaphragm Pump

Venturi Meters

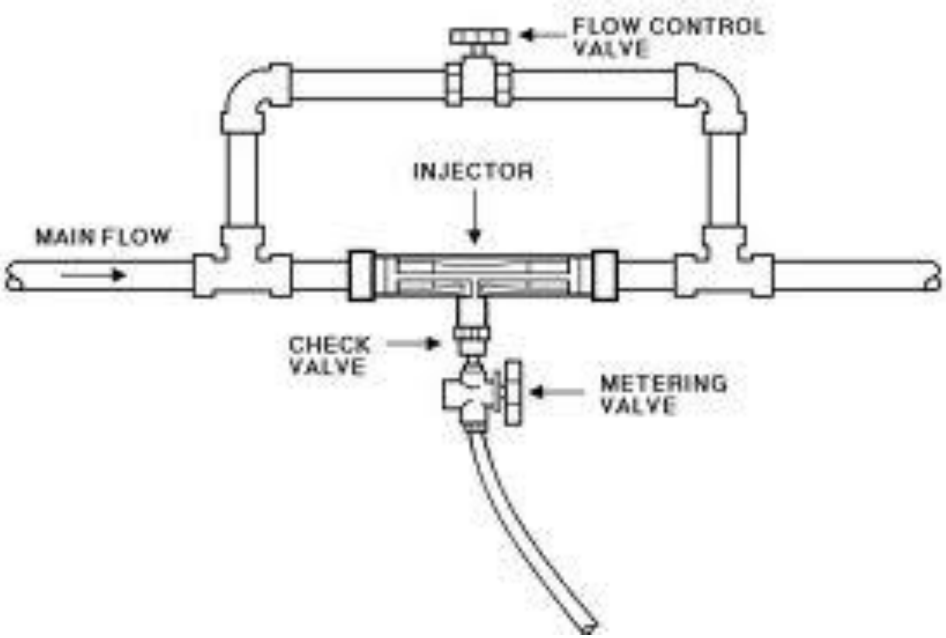
- Simple device with no moving parts
- The meter used a reduced diameter throat tube (or a tube with a needle valve or orifice plate)
- Velocity changes in tube create vacuum to pull chemical into stream
- Venturi Meters are sized based on system flow rate, pressure and desired injection rate

Venturi Meters

- Most low-end venturi injectors are not adjustable and have a constant proportion injection rate such as 1:50

(*one gallon injected for every 50 gallons flowing through meter)*

Venturi Meters



Chemigation Practices

Chemigation

General term that includes:

- Fertigation
- Insectigation
- Fungigation
- Nematigation

Advantages of Chemigation

- Uniformity of application
- Precise application
- Economics
- Timeliness
- Reduced soil compaction and crop damage
- Operator safety

Disadvantages of Chemigation

- High management
- Additional equipment
- Must calculate injection rates and volumes

Chemigation and Regulations

- General Classes
  - Controlled Substances
    - Pesticides and Herbicides
  - Fertilizers and Nutrients
  - Drip Maintenance/Clogging Control Chemicals
    - Chlorine and Acids

Controlled Substances

- Pesticides and Herbicides
  - Highly regulated by the EPA and States (TCEQ)
  - Regulations cover labeling, mixing/injection, and equipment
  - Regulations designed to protect the environment, human health and water supplies
  - State Licensing Requirements

Fertilizers

- Frequently injected into drip irrigation systems
- Dry and Liquid formulations are available
- Liquid formulations are more expensive but are very convenient
  - Can be injected directly (without mixing with water) with a variable rate injector.

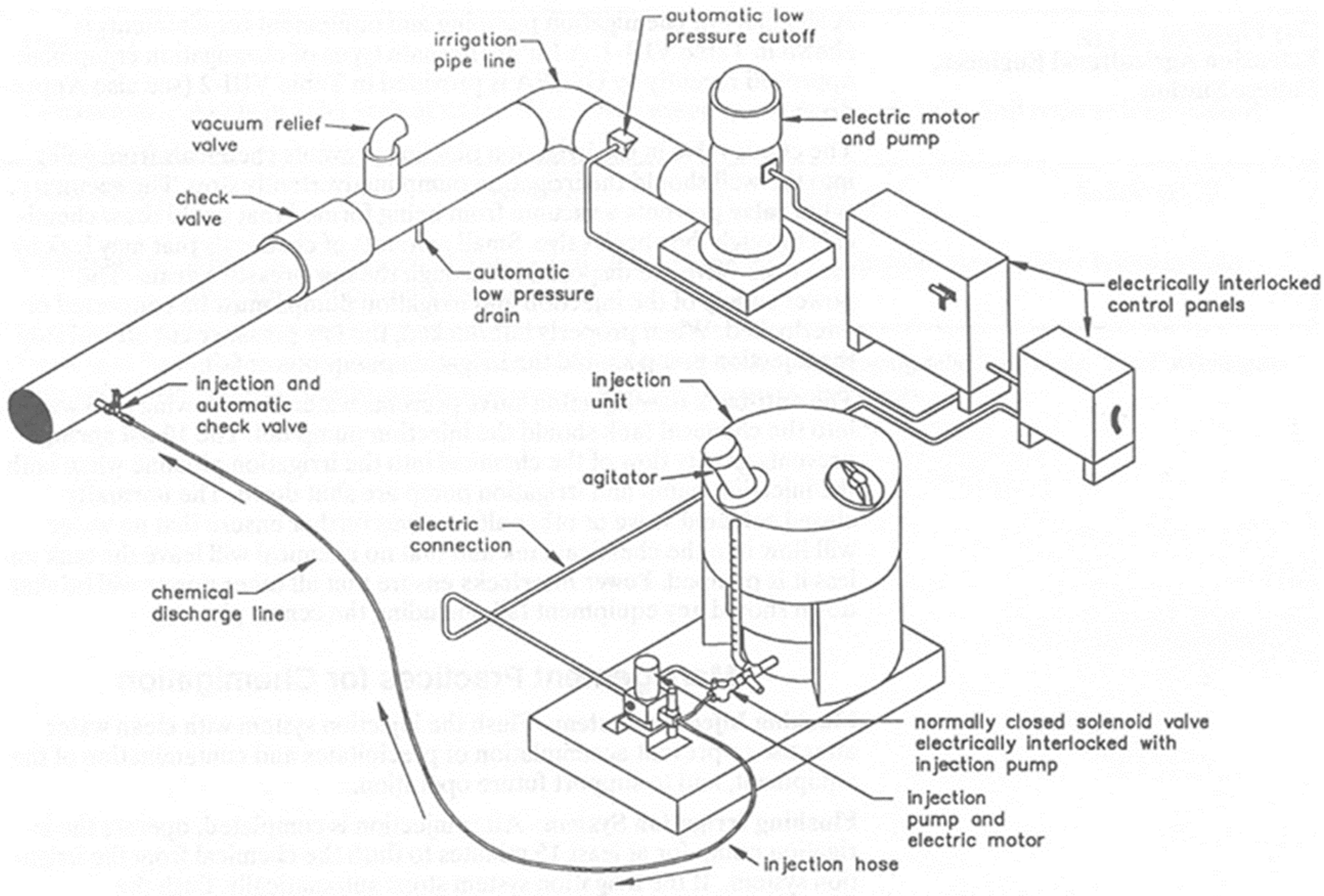
Fertilizers

- Fertilizers containing phosphorus and sulfur may react with calcium and/or magnesium in irrigation water
  - Forming precipitates that could clog emitters
- Micronutrients can also cause precipitates
- Consult with supplier before use or test prior to injection

The US EPA’s Label Improvement Program (LIP)

- Established in the 1980’s
  - Fully implemented in 1988
- States were required to implement regulations at least as stringent as proposed by the EPA
- Labels must state whether product is approved to be applied through the irrigation system
- Application instructions are provided
- Requires use of specific safety equipment and devices designed to prevent accidental spills

CHEMICAL INJECTION SAFETY CONNECTIONS



Clogging Control

Chemigation

Types of Clogging

- Biological
  - Aglae
  - Bacteria
- Mineral
  - Iron
  - Calcium/Lime
  - Salts
  - Etc.

Chlorine

- Injected to control biological clogging of lines and emitters
- Household bleach is often used in small systems (5.25% chlorine)
- 5 ppm solutions commonly used
- Higher concentrations (up to 100 ppm) if iron bacteria and/or organic matter are problems

Chlorine

- Chlorine concentration at the end of the drip line should be:

  - 1 to 2 ppm for occasional treatment

  - 0.5 to 1 ppm for continuous treatment

- Begin with a low concentration (5 ppm to 10 ppm) for one hour

Useful Conversion Factors

1 ppm = 1 mg/l

1 ppm = 1 mg/kg

1 % = 10,000 ppm

1 % = 1.33 oz (by weight) per gal of water

0.1% = 1000 ppm

Acid Injection

- Acid is injected to control mineral clogging of emitters
- Water with a high pH (>7.5) or

  “*moderate*” to “*hard water*” (>60 ppm Ca) more likely to cause problems

Acid Injection

- 98% sulfuric acid is commonly used in drip irrigation
- Citric acid or vinegar can be used in organic farming
- Titration can be used to determine concentration of acid need

(adding acid to a sample of the water to see how much is required to lower pH)

Acid Injection

- Laboratories can do a titration analysis which will determine the amount of acid needed to lower the water to a certain pH
- the injection rate (gal per hour) of acid is calculated by

$$IR = (A \times Q \times 60) / 326{,}000$$

IR= injection rate, gal per hr

A = gal of acid needed to lower pH (per ac-ft)

Q = Flow rate of irrigation system (gpm)

Acid Injection

- Experimentation is used in absence of titration
- Acid is injected until pH is lowered to 6.5 (measured at end of drip line)
- Higher concentrations are added if needed, lowering pH to as low as ~4
- Acid is corrosive – inject downsteam of filter if made of metal
    - Pay attention to any metal components in the irrigation system

Water Quality

- Highly Recommended water sources be tested prior to any chemigation to avoid negative reactions
- TAMU Soil Testing Lab has specific analysis for water used in drip irrigation
  - More info at http://SoilTesting.tamu.edu

1. Routine Analysis (R)	**$25 per sample**
(Conductivity, pH, Na, Ca, Mg, K, CO_3^{2-}, HCO_3^-, SO_4^{2-}, Cl^-, P, B, Nitrate-N. Hardness, and SAR)	
2. R + Metals	**$40 per sample**
In addition to Routine Analysis includes: (Zn, Fe, Cu, and Mn)	
3. R + Titrate of Drip Irrigation	**$33 per sample**
4. R + Metals + Titrate for Drip Irrigation	**$47 per sample**
5. R + Metals + Heavy metals and Fluoride	**$75 per sample**
In addition to test number 2, includes As, Ba, Cr, Cd, F, Ni, Pb.	
Hardcopy mailed to address listed above	**$2 per invoice**

Questions?

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