

Water Law

- **Riparian Doctrine:** "a landowner contiguous to a stream is entitled to have water of the stream flow by his/her land undiminished in quantity and unpolluted in quality"
 - Based on English common law
 - Ground water context: ownership of overlying land
 - Doctrine is often modified to the concept of "reasonable use"
- **(Prior) Appropriation Doctrine:** "diverting water and putting it to a beneficial use creates a water right"
 - Early miners' claims: "first in time is first in right"

Beneficial Uses

- Domestic
- Industrial
- Irrigation
- Livestock
- Power generation
- Recreation
- Aquatic life

Water Rights

(cornerstone of the Appropriation Doctrine)

- Water is owned by the public
- State can grant the right to use water
- Certain quantity, certain use, certain point of diversion
- Priority is very important (senior vs. junior rights)
- Can be bought and sold
- No guarantee of water
- Non-use forfeits the right
- Normally administered through a permit system

Oklahoma Water Rights

- Combination of Riparian and Appropriation Doctrines (like most western US states)
- Owning land over groundwater or by a stream grants domestic use by Riparian Doctrine
 - Household use
 - Irrigate 3 acres or less (for any purpose)
 - Water free range livestock at normal stocking rate
- All other uses require a permit under Appropriation Doctrine (OK Water Resources Board)

Chemigation

Chemigation

- Chemigation is the process of applying pesticides and fertilizer through irrigation water
- EPA regulations require that the water source be protected from contamination by chemical solutions in case of unscheduled system shutdown
- Only products specifically labeled for chemigation may be applied in this manner

Chemigation System Requirements

Irrigation System Backflow Prevention

- The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow.

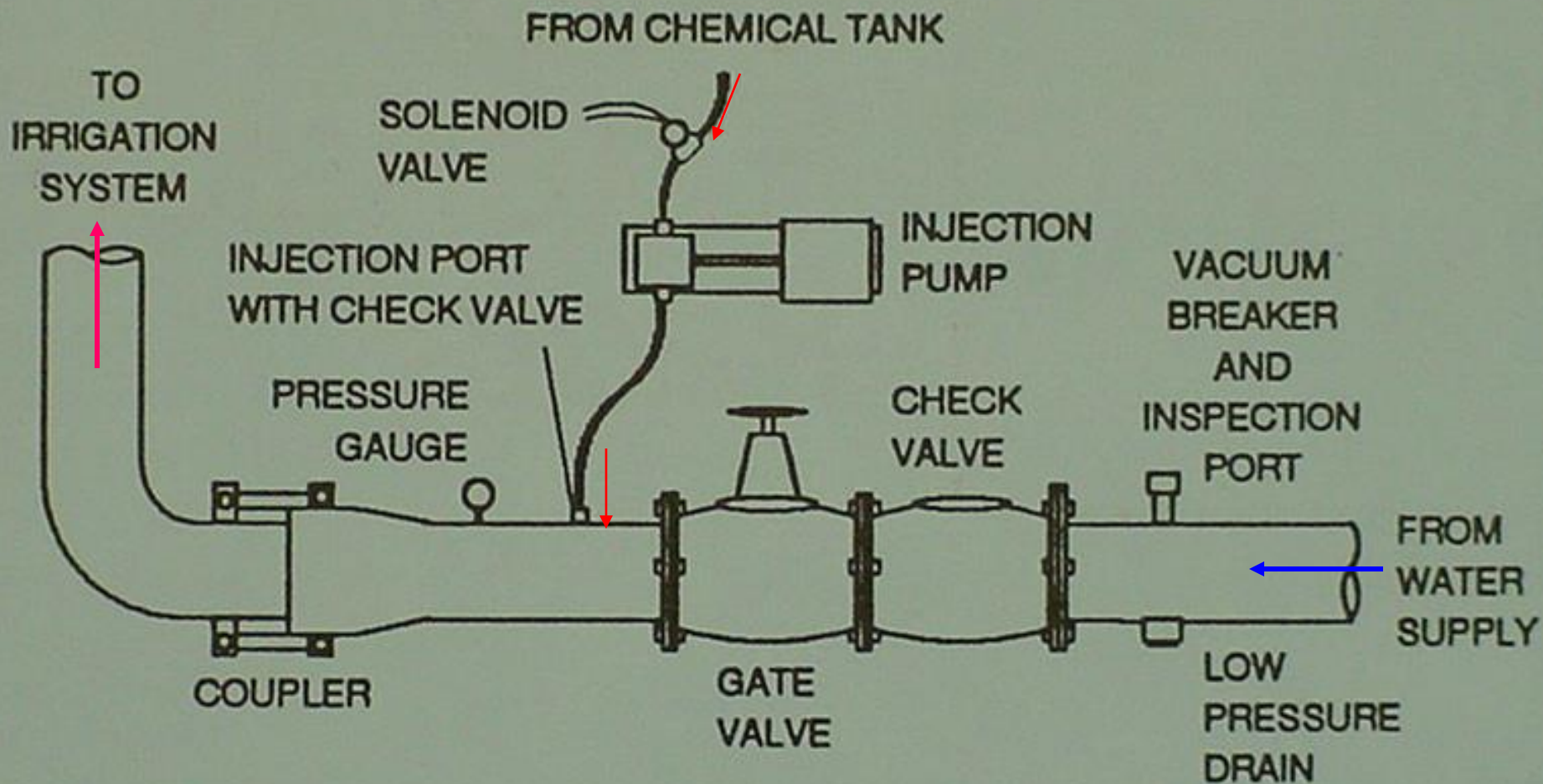


Figure 1. Backflow prevention devices for the irrigation and chemical systems.

Chemigation Check Valve

Vacuum Relief Valve



Inspection Port



Check Valve

Low Pressure Drain



Chemigation System Requirements

Pesticide System Backflow Prevention

- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.

Chemigation System Requirements

Pesticide Pipeline Interlock

- The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
- Pesticide injection pipeline check valve with a 10 psi minimum opening pressure is an acceptable alternative device.

Chemigation System Requirements

Pesticide Injection Pump Interlock

- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.

Chemigation System Requirements

Irrigation System Low Pressure Shutdown

- The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.

Chemigation System Requirements

Pesticide Injection Devices

- Systems must use a metering pump, such as a positive displacement injection pump (For example, a diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock

Chemical Injection Pump

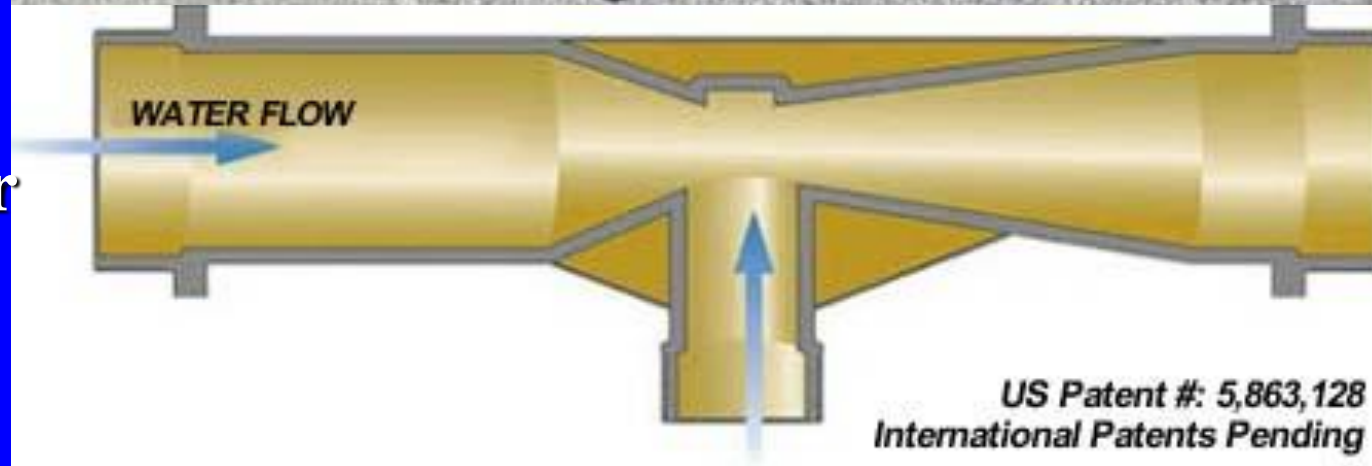


Venturi Chemical Injector

Bypass venturi injection device for injection of liquid chlorine, liquid fertilizer or acid.



Cutaway of a venturi injector cross-section.



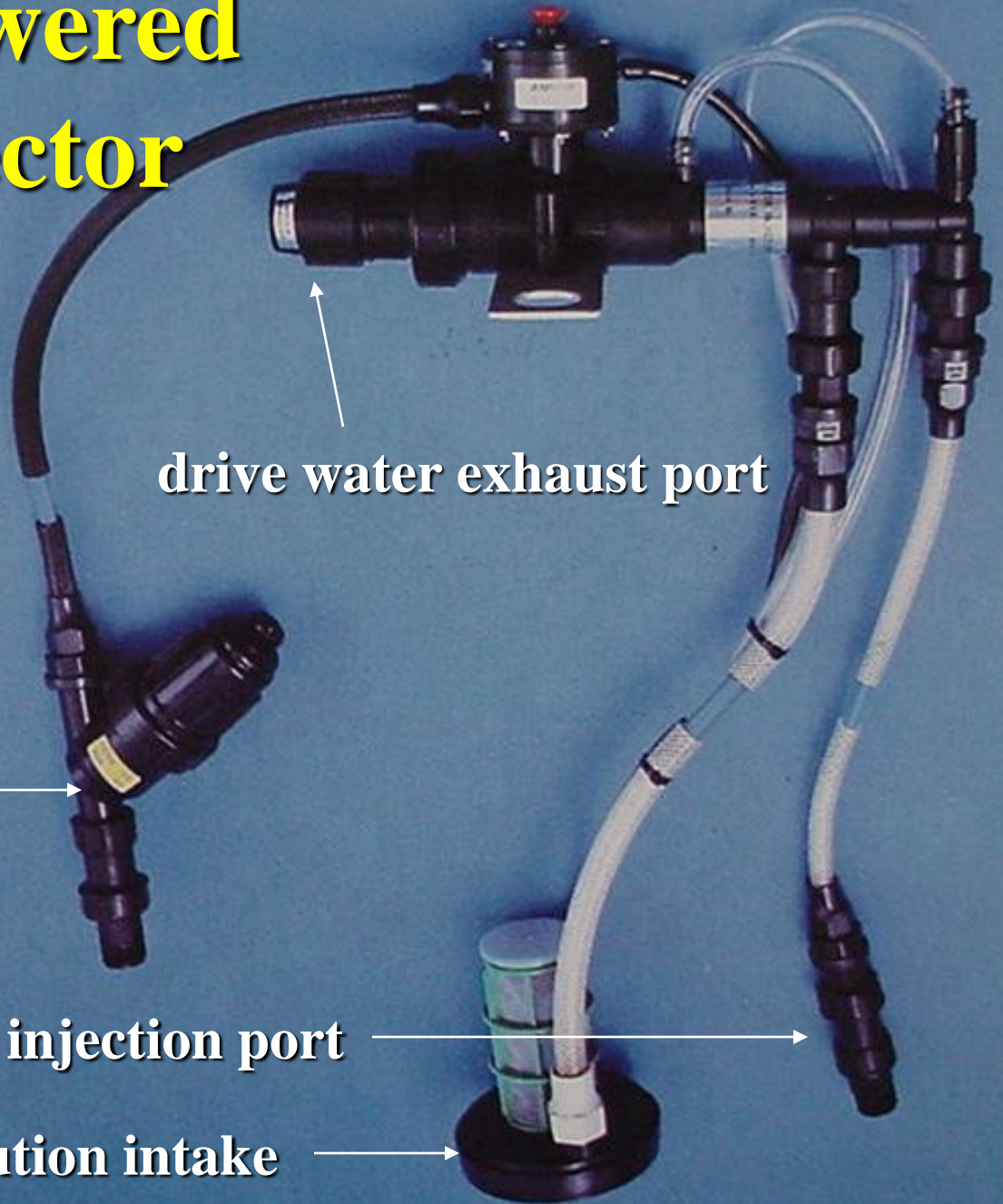
Hydraulic Powered Chemical Injector

drive water inlet & filter

drive water exhaust port

chemical solution injection port

chemical solution intake



Chemigation System Requirements

Monitoring Weather Conditions

- Do not apply when wind speed favors drift beyond the area intended for treatment.

Chemigation Safety Equipment for Engine-Driven Irrigation System

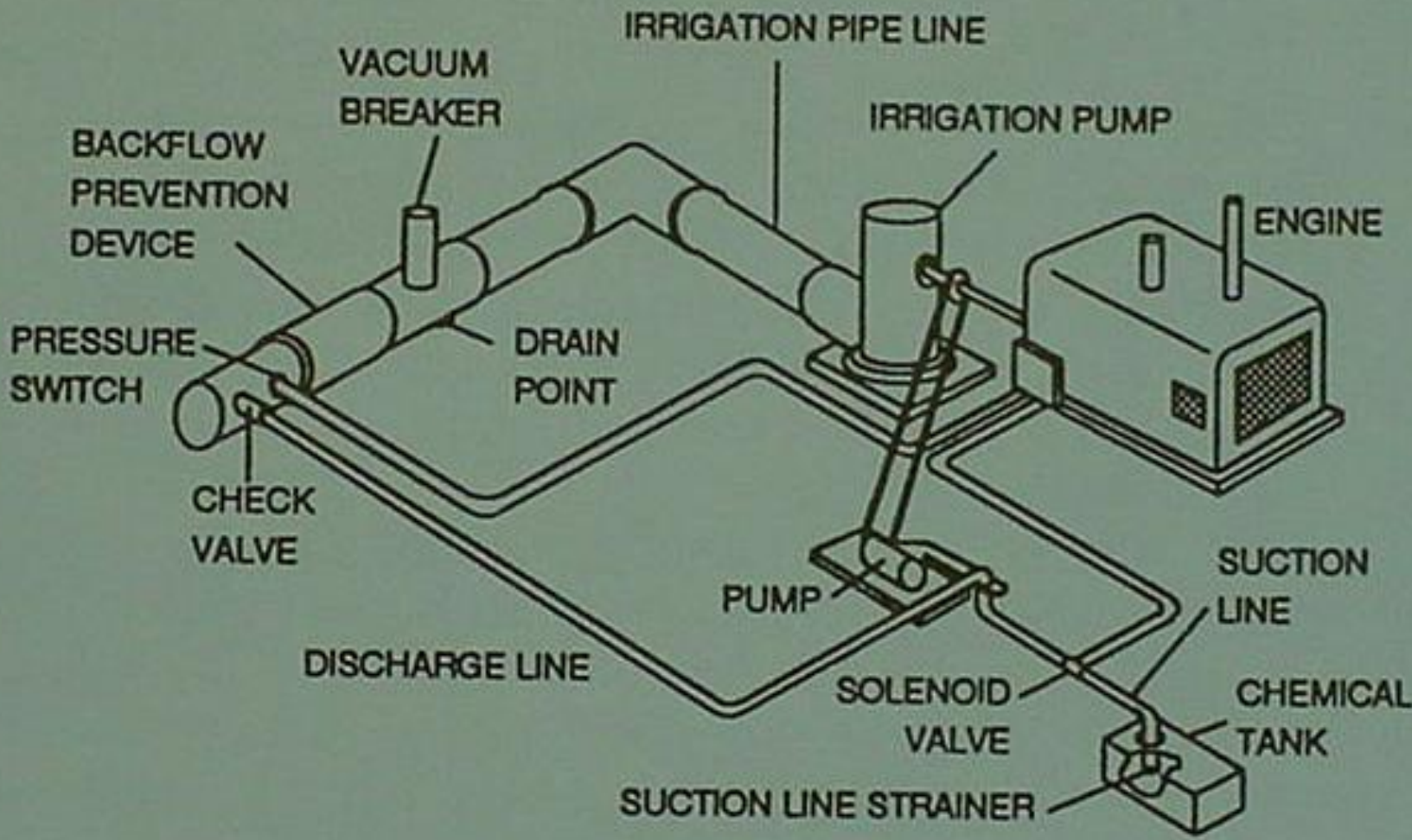


Figure 3. Chemigation safety devices used in engine powered irrigation systems.

Chemigation Safety Equipment for Electric Irrigation System

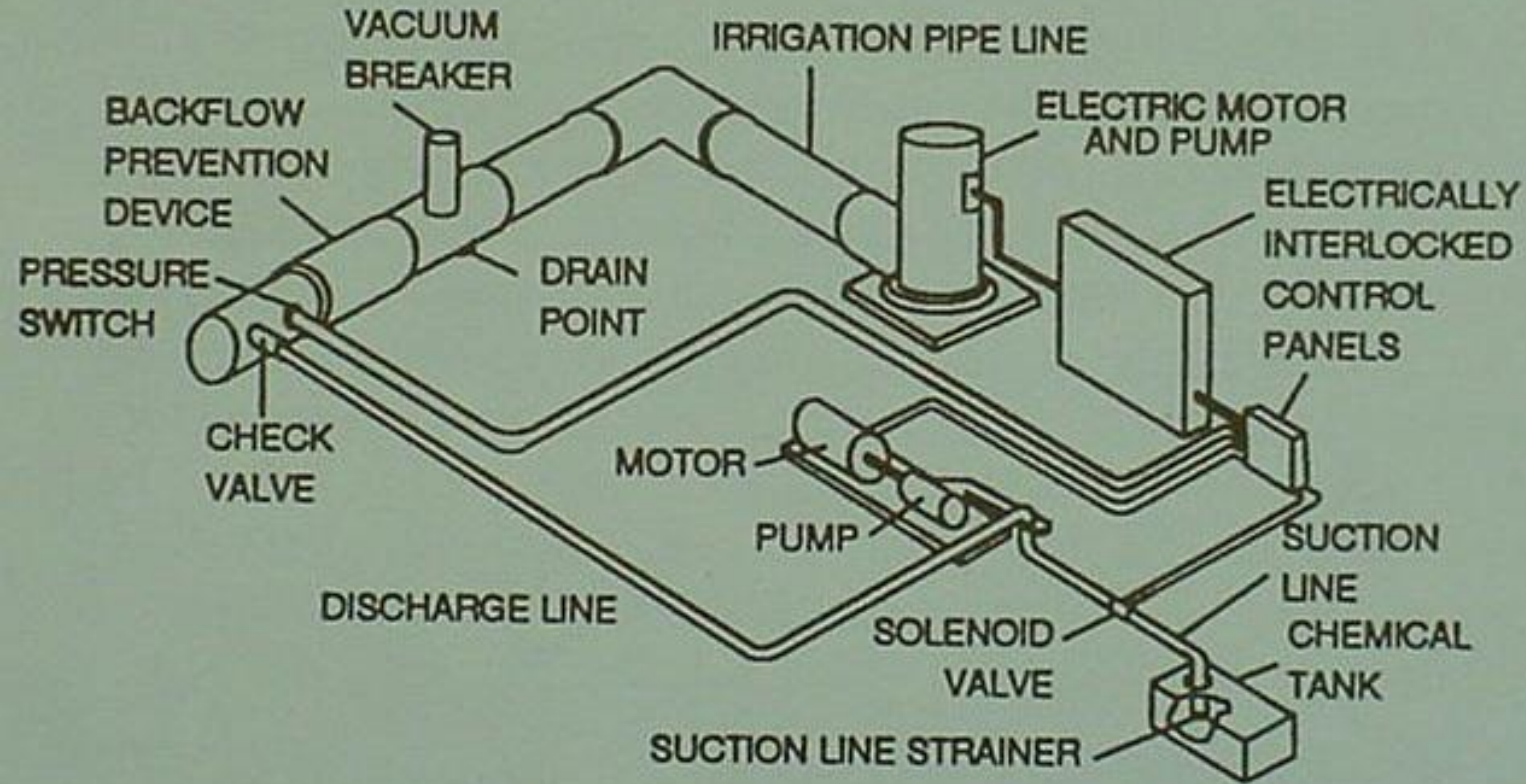


Figure 2. Chemigation safety devices used in electric motor powered irrigation systems.

Chemigation

- Proper system calibration
- “The Label is the Law”
- Certification is required for pesticide applicators (chemigation, conventional ground application systems, and aerial)
- OSU Extension Entomologists offer applicator certification programs at several locations around the state

Chemigation Calibration

Batch System

A sprinkler irrigation zone covers a total area of 1.2 acres with a flow rate of 145 gpm. You want to apply a pesticide product that has a concentration of 41% ai (active ingredient). The manufacturer's label recommends a rate of 2.5 pints ai/acre with a 0.25 inch total water application, with 0.05 inch of irrigation water applied after the product injection is complete. What chemical injection rate and injection time should be used for this product? How long should the system run after injection is complete?

Application Rate, A_r (in/hr):

$$= 96.3 Q(\text{gpm}) / A(\text{ft}^2) = (96.3 \times 145) / (1.2 \times 43560) = 0.27 \text{ in/hr}$$

Total Application Time:

$$= 0.25 \text{ in} / 0.27 \text{ in/hr} = 0.926 \text{ hr} \times 60 \text{ min/hr} = 55.55 \text{ min} \leftarrow$$

Chemigation Calibration

Batch System, Continued

Injection Time:

$0.25 \text{ in} - 0.05 \text{ in (after injection)} = 0.20 \text{ in during injection time}$

$0.20 \text{ in} / 0.27 \text{ in/hr} = 0.74 \text{ hr} \times 60 \text{ min/hr} = \underline{44.4 \text{ minutes}} \leftarrow$

Application amount: $2.5 \text{ pts ai/acre} \times 1.2 \text{ acres} = 3 \text{ pts ai}$

$3 \text{ pts ai} / 0.41 \text{ ai conc.} = 7.3 \text{ pts of product to be applied} \leftarrow$

Injection rate:

$7.3 \text{ pts of product} / 44.4 \text{ minutes} = \underline{0.165 \text{ pts/min}} \leftarrow$

Post-injection on-time:

$0.05 \text{ inch of water applied after injection} / 0.27 \text{ in/hr } A_r = 0.185 \text{ hr}$

$0.185 \text{ hr} \times 60 \text{ min/hr} = \underline{11.1 \text{ min.}} \leftarrow$

Chemigation Calibration

Continuously Moving System

A center pivot irrigation system covers a total area of 125 acres with a flow rate of 750 gpm. The system makes a complete circuit of the field in 22 hours at the 100% speed setting. You want to apply a pesticide product that has a concentration of 36% ai (active ingredient). The manufacturer's label recommends a rate of 1.5 pints ai/acre with a 0.50 inch total water application. What percent speed setting should be used during application? What chemical injection rate and injection time should be used for this product?

Application Time, T_a , for 0.50 inch depth:

$$T_a = 453 \text{ d A} / Q = (453 \times 0.50\text{in} \times 125\text{A} / 750\text{gpm}) = \underline{37.75 \text{ hr}} \leftarrow$$

Percent Setting, P , for 37.75 hr travel time:

$$P = 100 (T_{\min}) / T_a = 100(22\text{hr}) / 37.75\text{hr} = \underline{58\%} \leftarrow$$

Chemigation Calibration

Continuously Moving System, Continued

Amount of product to apply:

$$1.5 \text{ pts ai/A} \times 125 \text{ A} = 187.5 \text{ pts ai}$$

$$187.5 \text{ pts ai} / 0.36 \text{ ai conc.} = \underline{520.8 \text{ pts of product for 125 A}} \leftarrow$$

Product injection rate:

$$520.8 \text{ pts} / (37.75 \text{ hr} \times 60 \text{ min/hr}) = \underline{0.23 \text{ pt/minute}} \leftarrow$$