Agricultural Chemigation System Safety

Agricultural Chemigation System Safety

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Thanks to Mike Howard of Bayer Corp. and Will Suckow of UC Communication Services

Chemigation

Chemigation is the application of a chemical through the irrigation system by mixing the chemical with the irrigation water.

Chemigation of labeled chemicals

The label specifies the "Required System Safety Devices" in the "USE IN CHEMIGATION SYSTEMS" section.

EPA, CA Dept. of Pesticide Regulation (DPR), and the County Ag Commissioners are all involved in setting and enforcing chemigation standards.

Chemigation Safety

This presentation concentrates on :

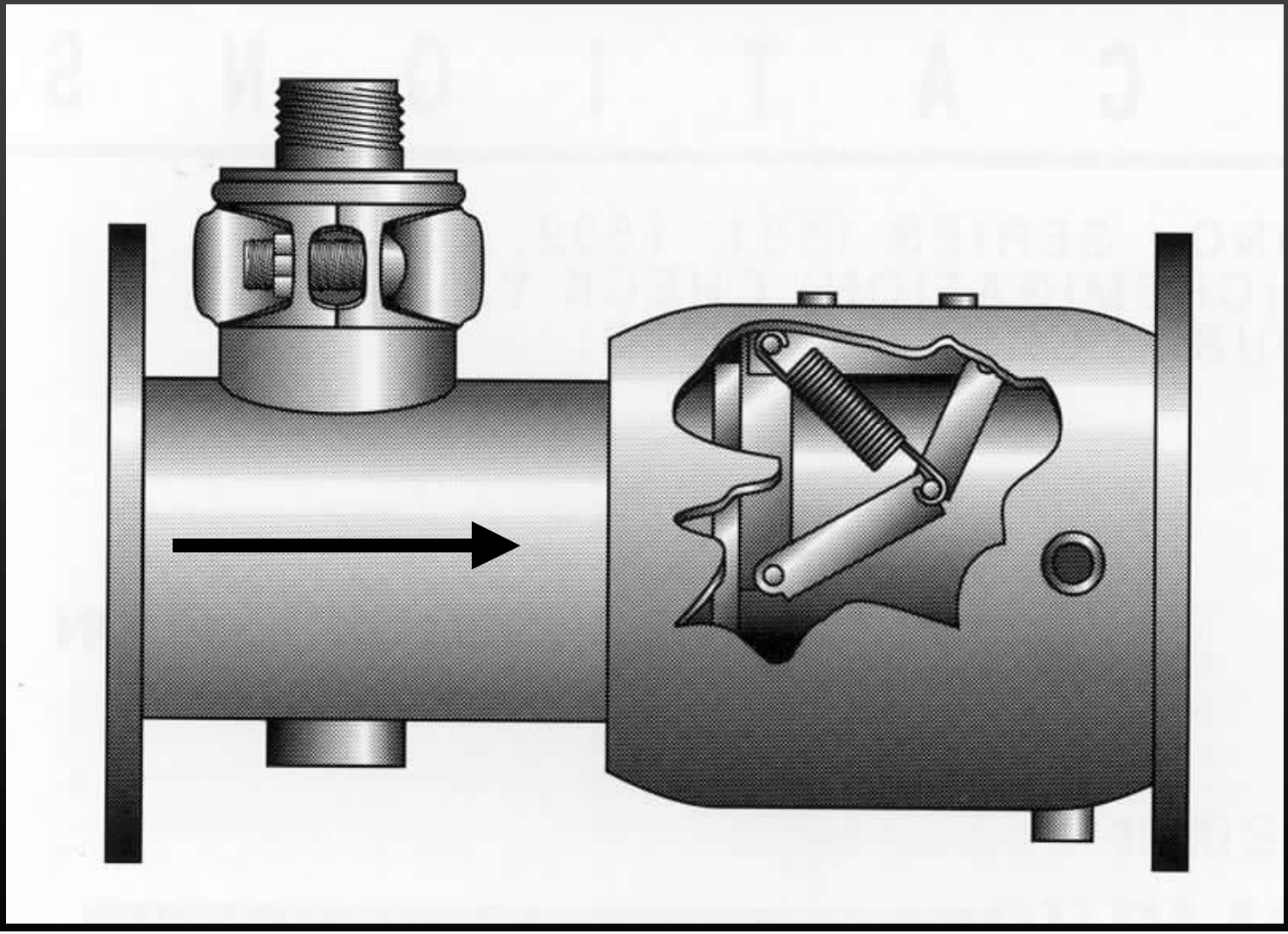
- Chemigation hardware and safety issues
- It does not address other chemigation management issues

Chemigation Safety - Required Safety Devices

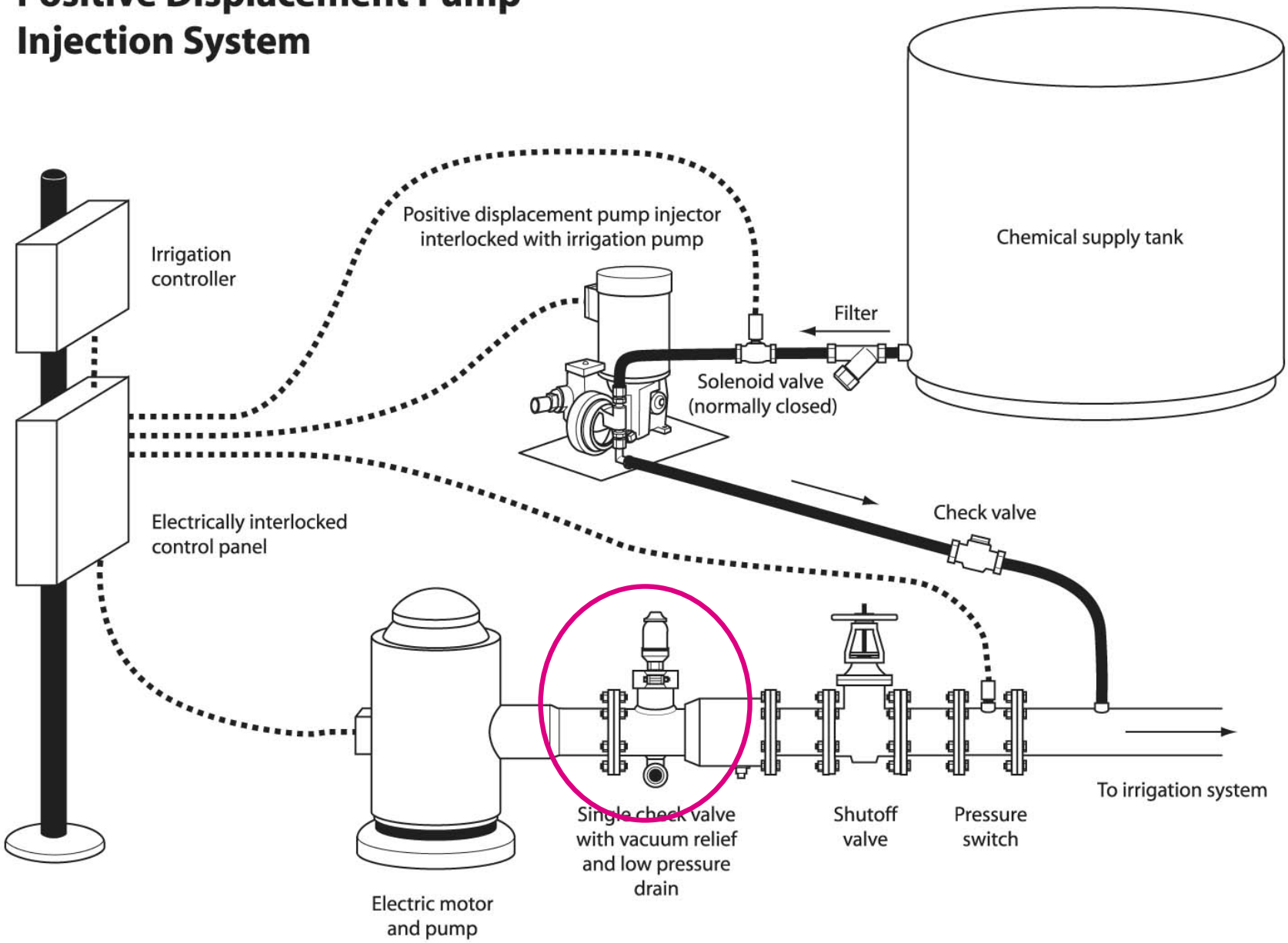
1. “A functional check valve, vacuum relief valve, and a low pressure drain”.

Purpose: No water movement back to the water source

Single Check Valve



Positive Displacement Pump Injection System



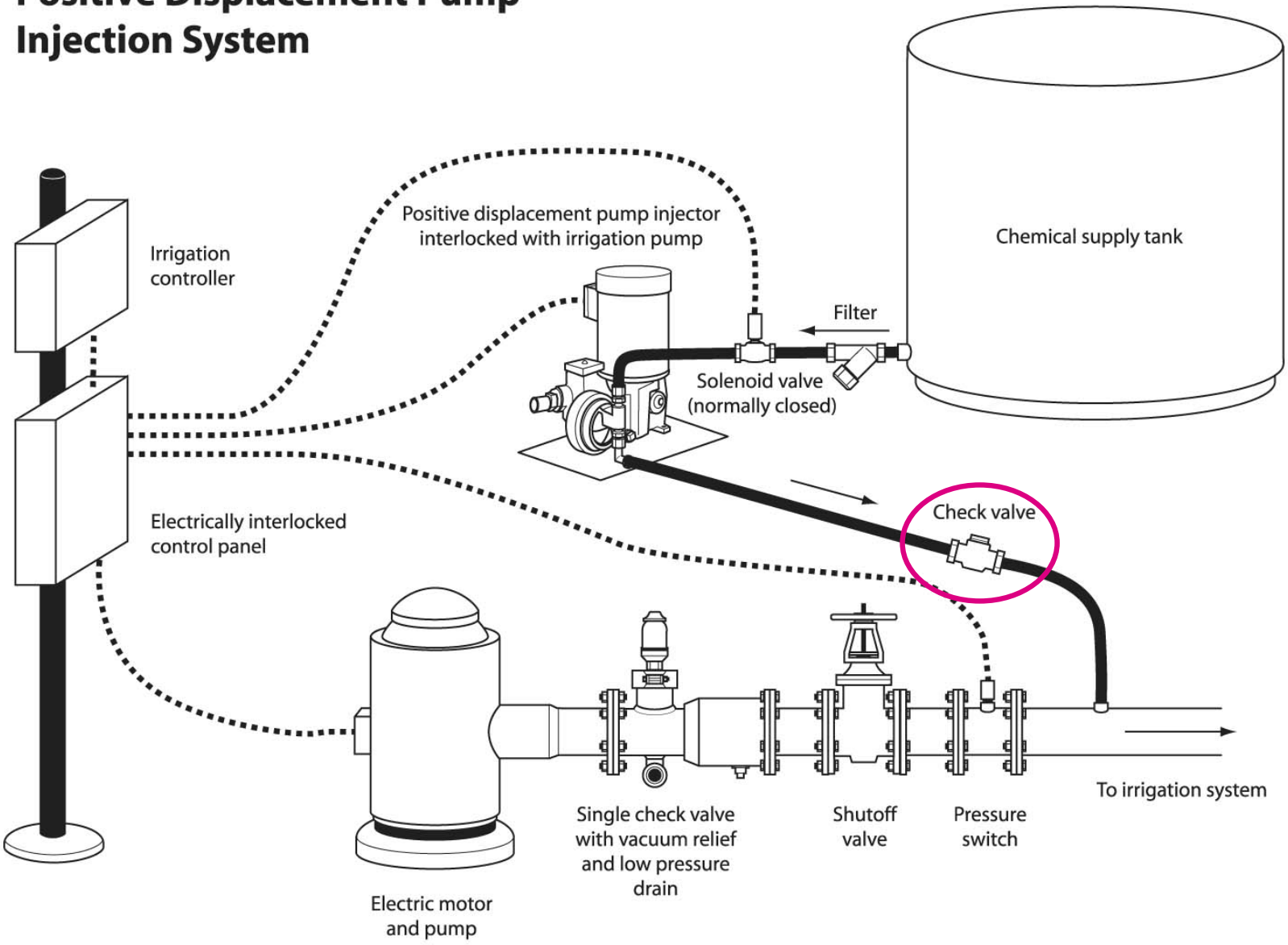
Chemigation Safety - Required Safety Devices

1. "A functional check valve, vacuum relief valve, and a low pressure drain". (No water movement back to the water source).

2. "Automatic, quick-closing check valve to prevent backflow toward the injection pump".

Purpose: prevent overflow of the storage tank

Positive Displacement Pump Injection System

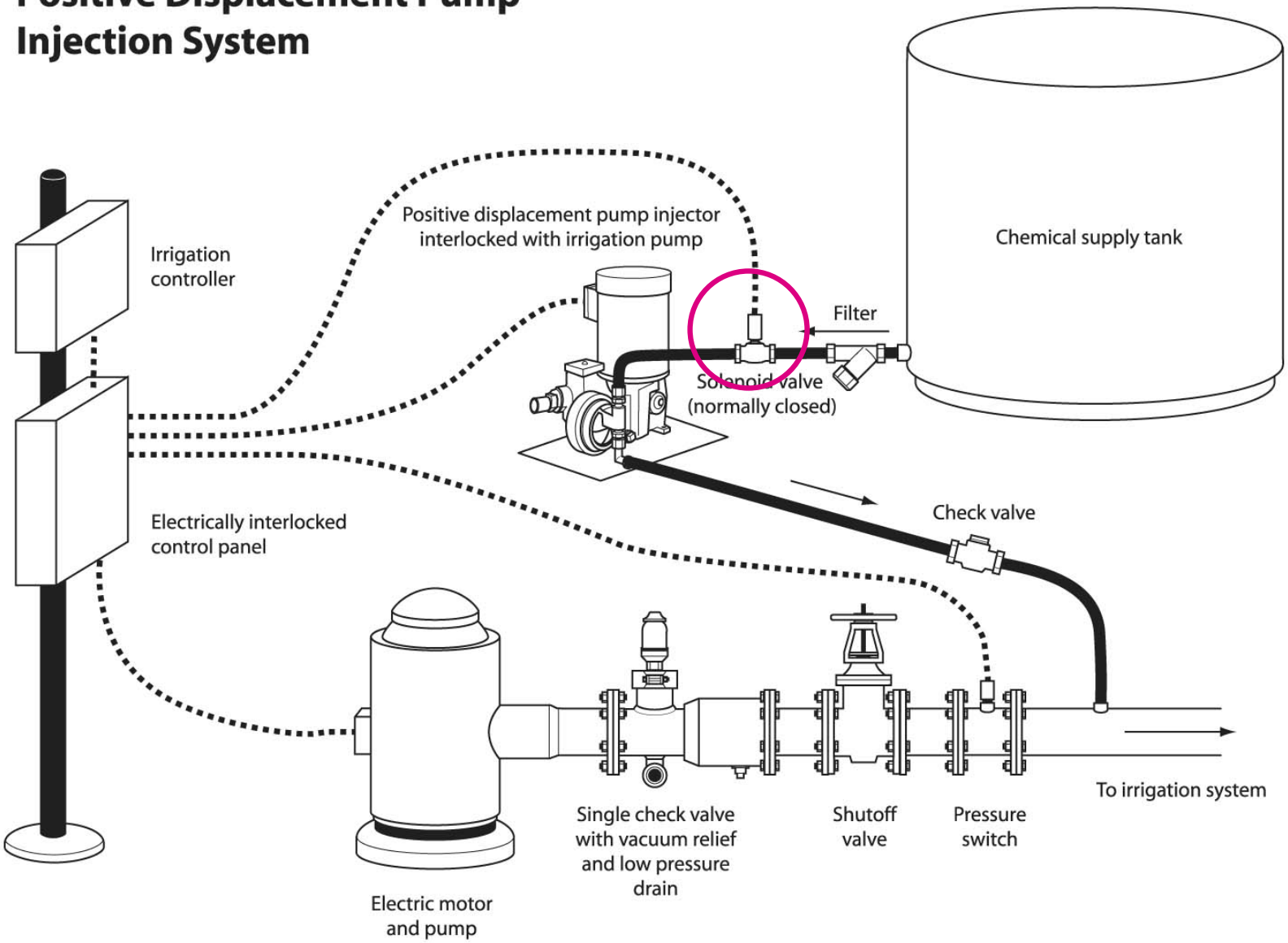


Chemigation Safety - Required Safety Devices

1. "A functional check valve, vacuum relief valve, and a low pressure drain". (No water movement back to the water source)
2. "Automatic, quick-closing check valve to prevent backflow toward the injection pump". (Do not want to overflow the storage tank)
3. " Normally-closed solenoid valve on intake side of injection pump, interlocked to pump".

Purpose: Prevent flow of chemical to the injector if the pump is shut down.

Positive Displacement Pump Injection System



Chemigation Safety - Required Safety Devices

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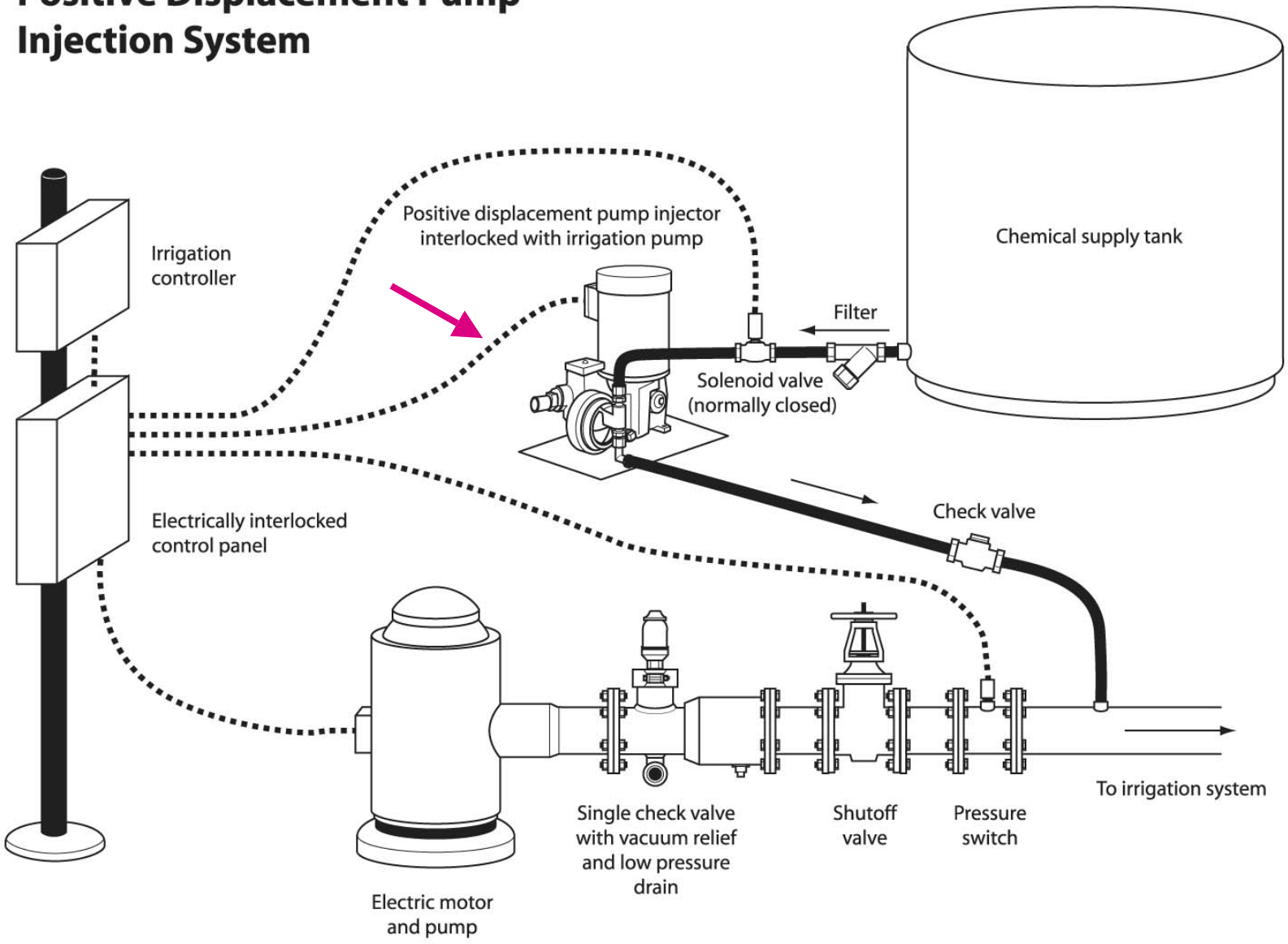
2. "Automatic, quick-closing check valve to prevent backflow toward the injection pump". (Do not want to overflow the storage tank)
3. " Normally-closed solenoid valve on intake side of injection pump, interlocked to pump". (No flow of chemical to injector if the pump is shut down)
4. **"The injection pump is interlocked to the irrigation pump".**

Purpose: No injection will occur without water running.

Positive Displacement Pump Injection System

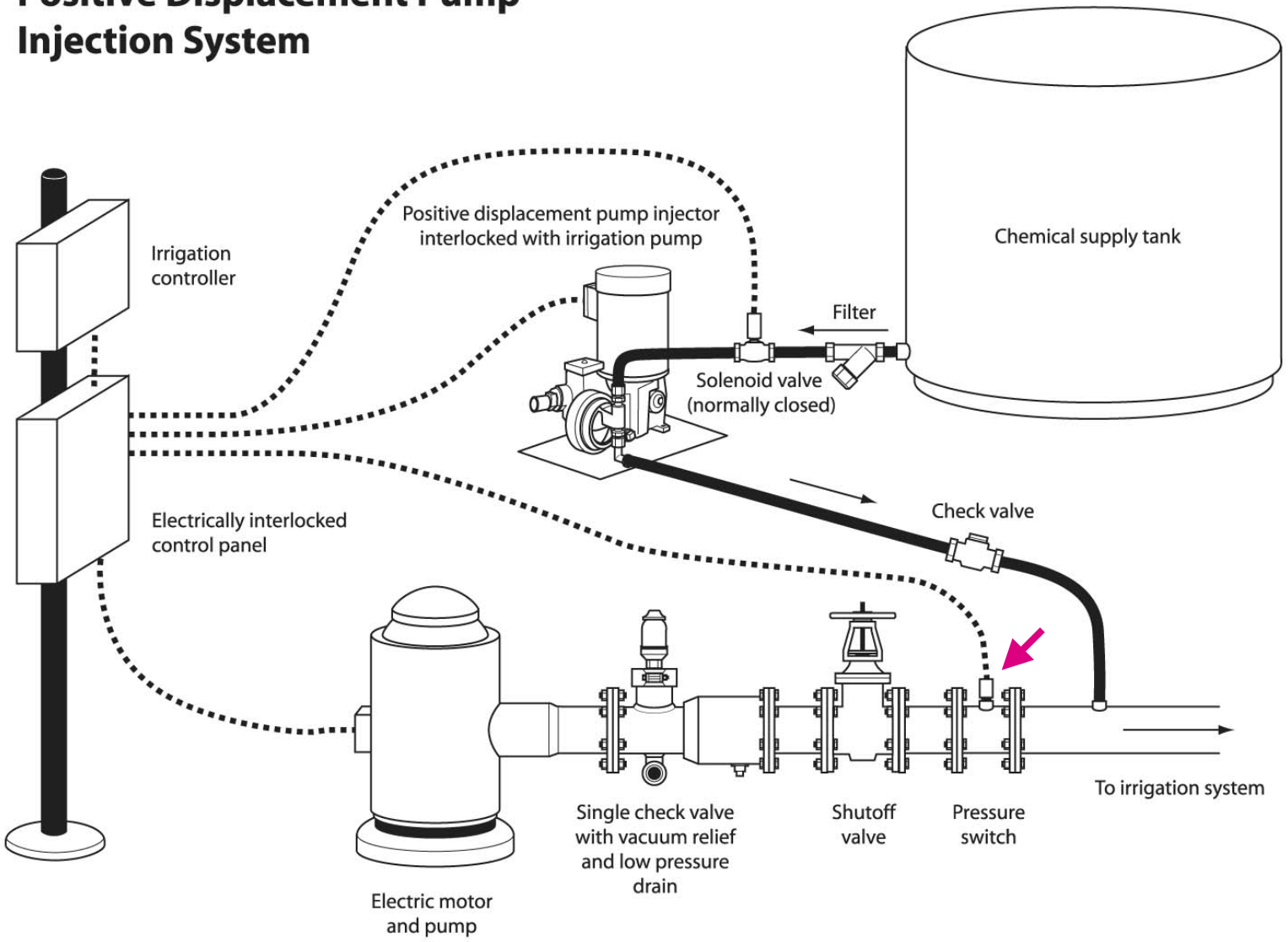


Chemigation Safety - Required Safety Devices

1. "A functional check valve, vacuum relief valve, and a low pressure drain". (No water movement back to the water source)
2. "Automatic, quick-closing check valve to prevent backflow toward the injection pump". (Do not want to overflow the storage tank)
3. "Normally-closed solenoid valve on intake side of injection pump, interlocked to pump". (No flow of chemical to injector if the pump is shut down)
4. " The injection pump is interlocked to the irrigation pump". (No injection will occur without water running)
5. **"Pressure switch in the irrigation line which will stop the irrigation pump".**

Purpose: Stops irrigation and injection if there is a break in the irrigation line.

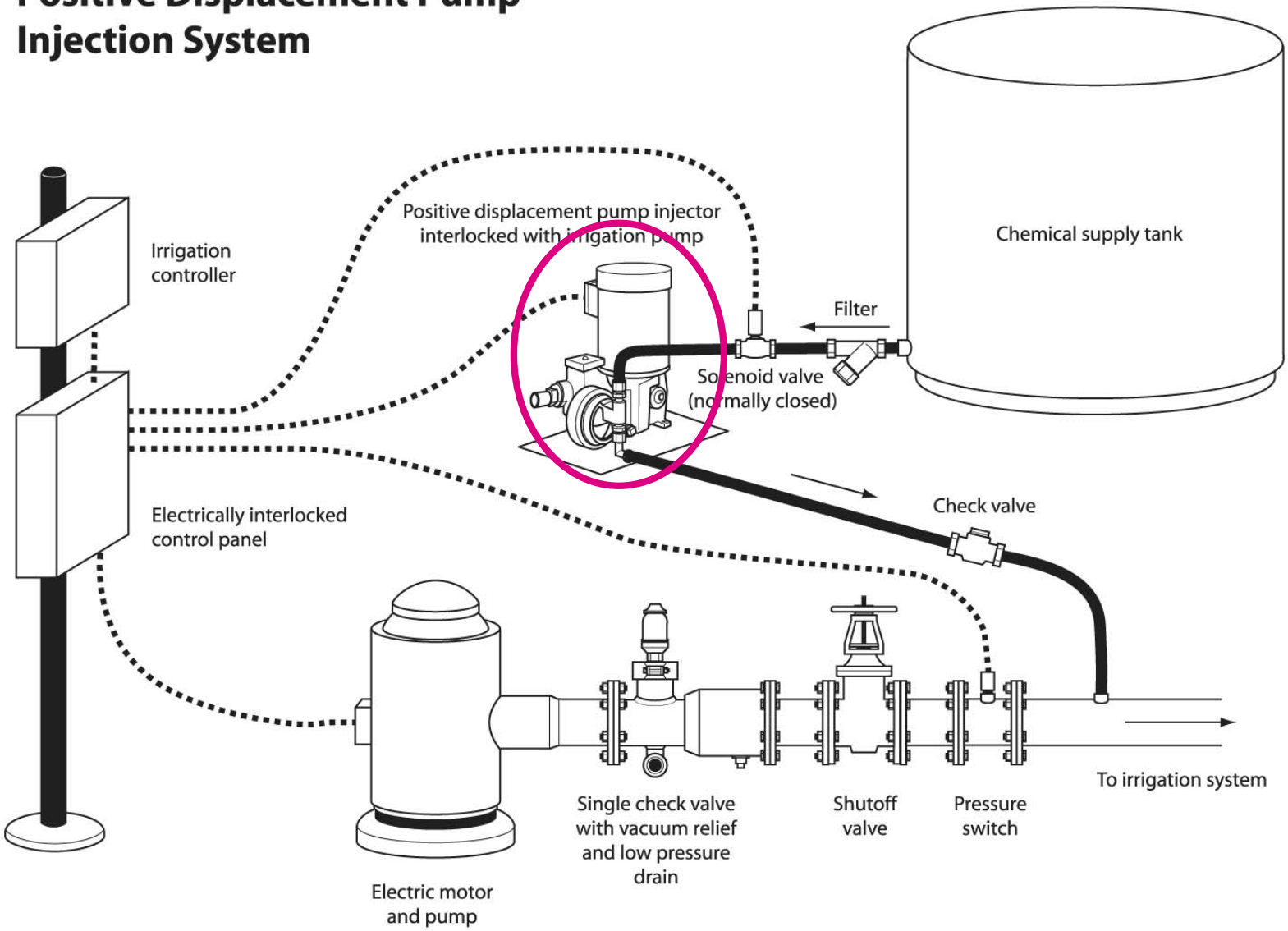
Positive Displacement Pump Injection System



Chemigation Safety - Required Safety Devices

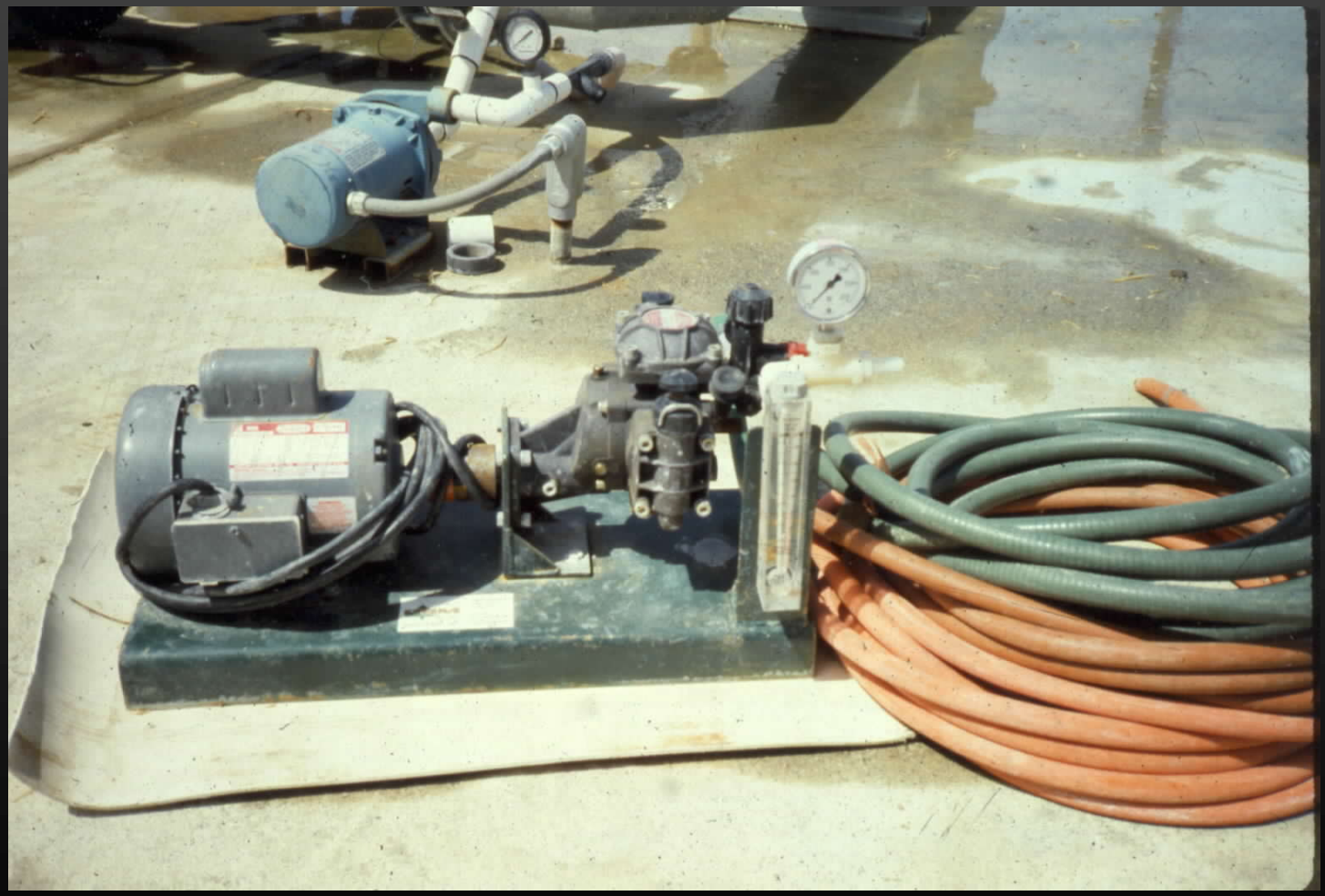
1. "A functional check valve, vacuum relief valve, and a low pressure drain". (No water movement back to the water source)
2. "Automatic, quick-closing check valve to prevent backflow toward the injection pump". (Do not want to overflow the storage tank)
3. "Normally-closed solenoid valve on intake side of injection pump, interlocked to pump". (No flow of chemical to injector if the pump is shut down)
4. " The injection pump is interlocked to the irrigation pump". (No injection will occur without water running)
5. "Pressure switch in the irrigation line which will stop the irrigation pump". (Stops irrigation and injection if there is a break in the irrigation line)
6. **"Use a metering pump (positive displacement pump for injection. Positive displacement pumps include piston/cylinder pumps and diaphragm pumps".**

Positive Displacement Pump Injection System



Positive Displacement Pump - Piston / Cylinder

Positive Displacement Pump - Diaphragm Pump



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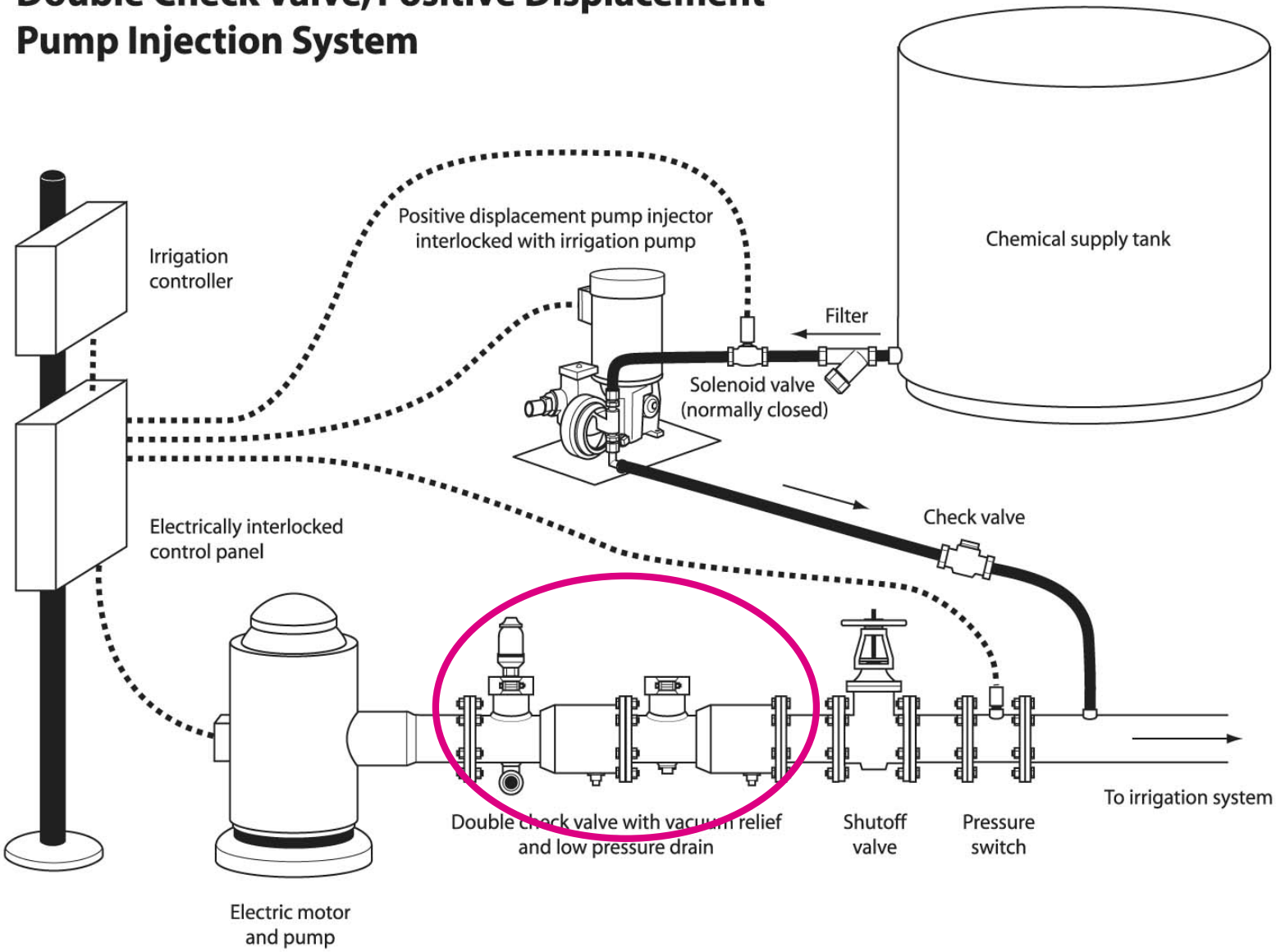
- Some regulations require a double check valve system to provide safety redundancy.

Double Check Valve, Positive Displacement Pump Injection System



Double Check Valve

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Some locales even require a ***Pressure Reducing Backflow Prevention Valve***. These are the backflow prevention valves used on urban water systems and they are extremely expensive.

Pressure Reducing Backflow Prevention Valve

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There are also approved alternatives to the label's list of Required System Safety Devices. They include:

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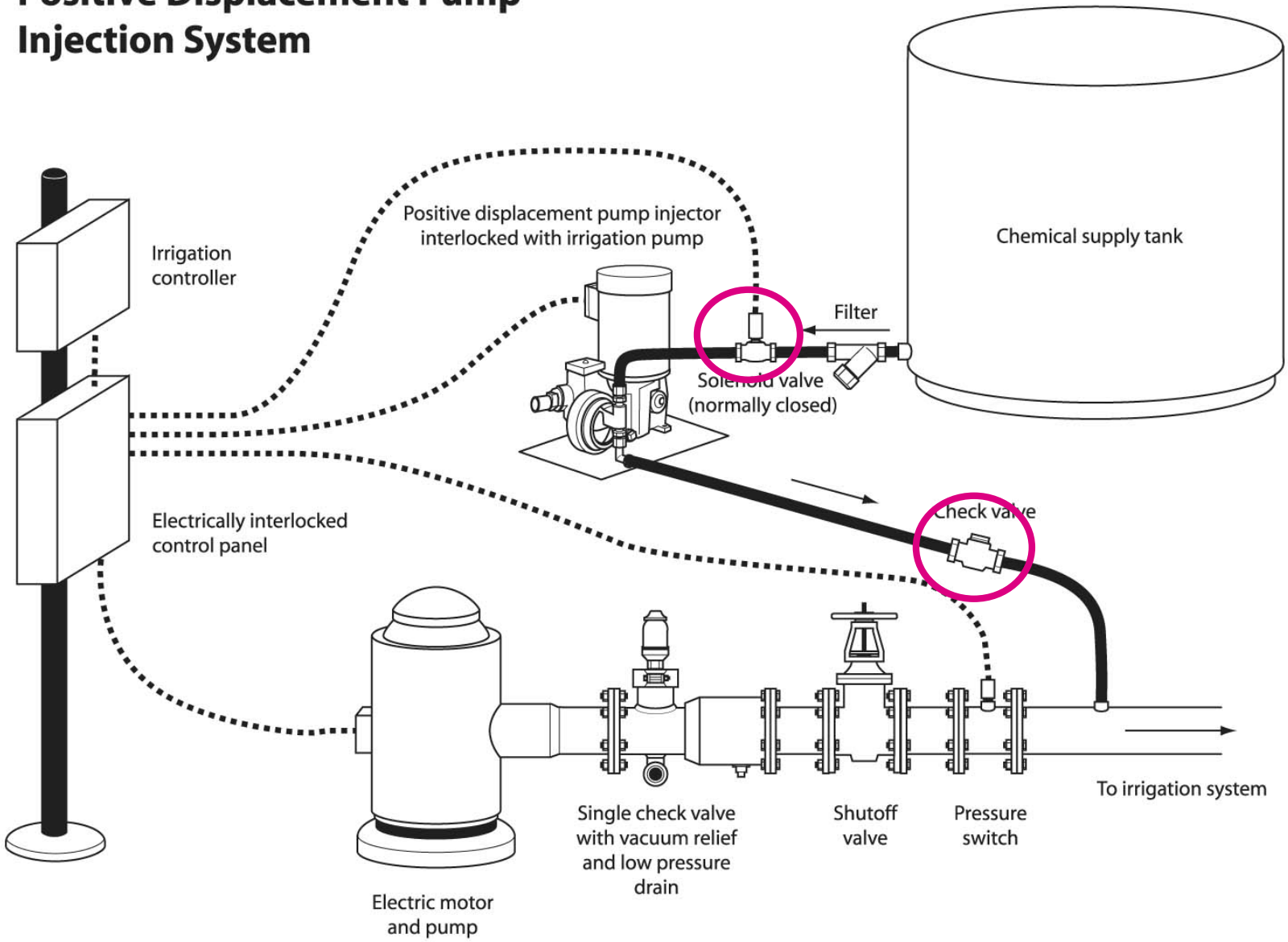
Alternative devices:

Replacing the normally-closed solenoid valve on the injection pump line with a "*functional spring-loaded check valve with a minimum of 10 psi cracking pressure*".

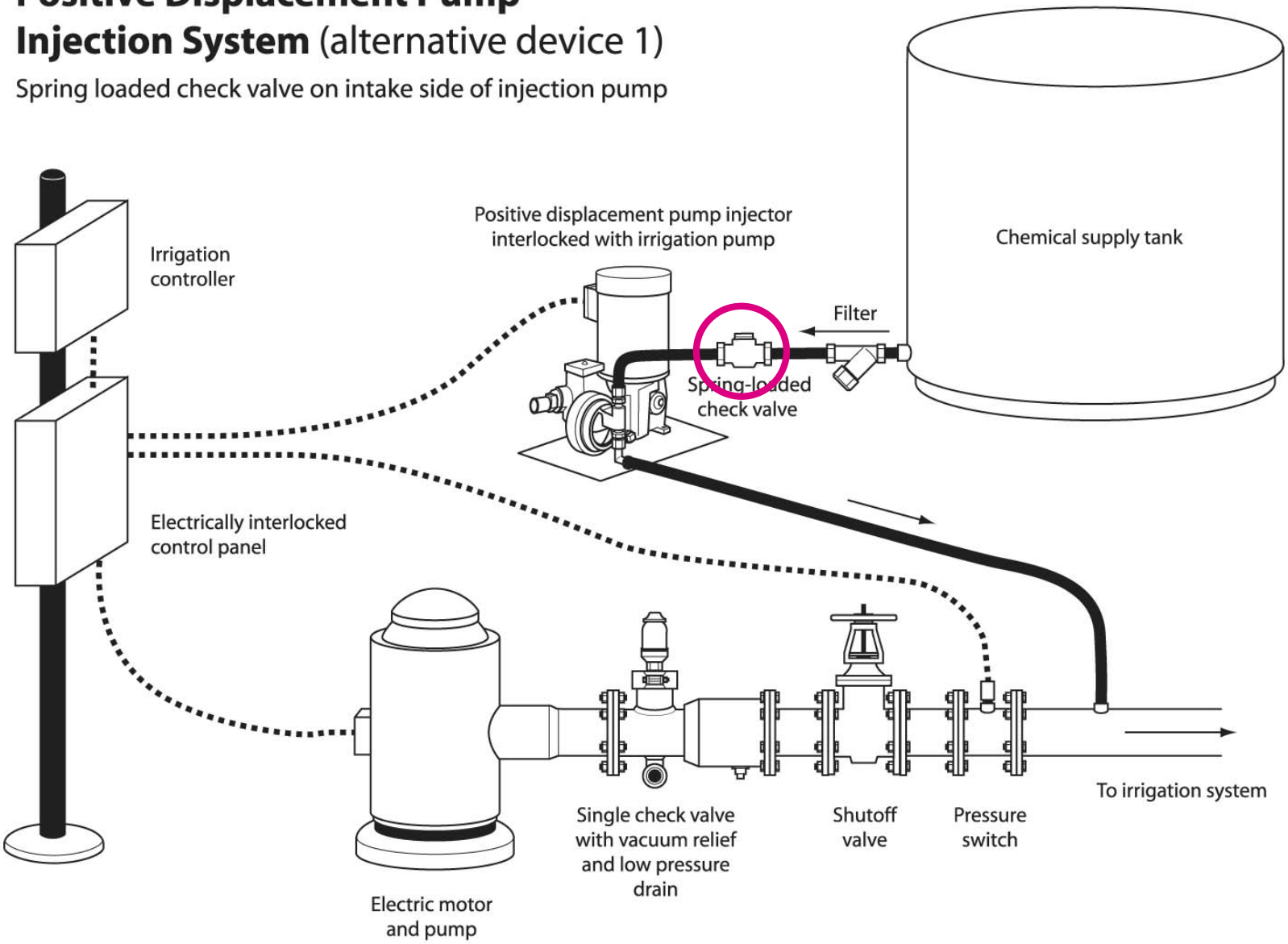
"*This single device can substitute for both the solenoid-operated valve and the automatic, quick-closing check valve in the pesticide line*".

Positive Displacement Pump Injection System



Positive Displacement Pump Injection System (alternative device 1)

Spring loaded check valve on intake side of injection pump



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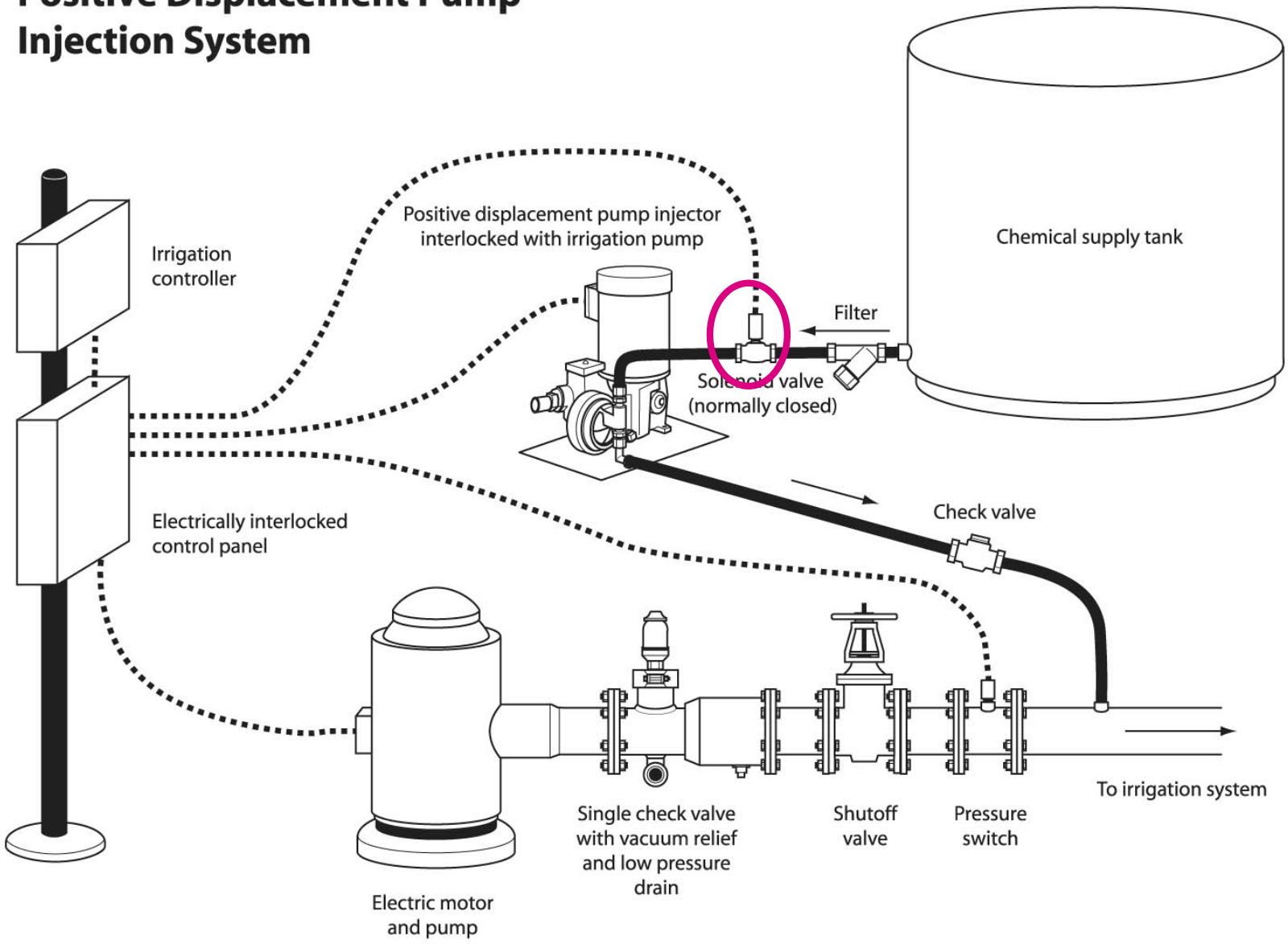
Alternative devices:

Replacing the normally-closed solenoid valve on the injection pump line with a "*functional normally-closed, hydraulically operated check valve'*.

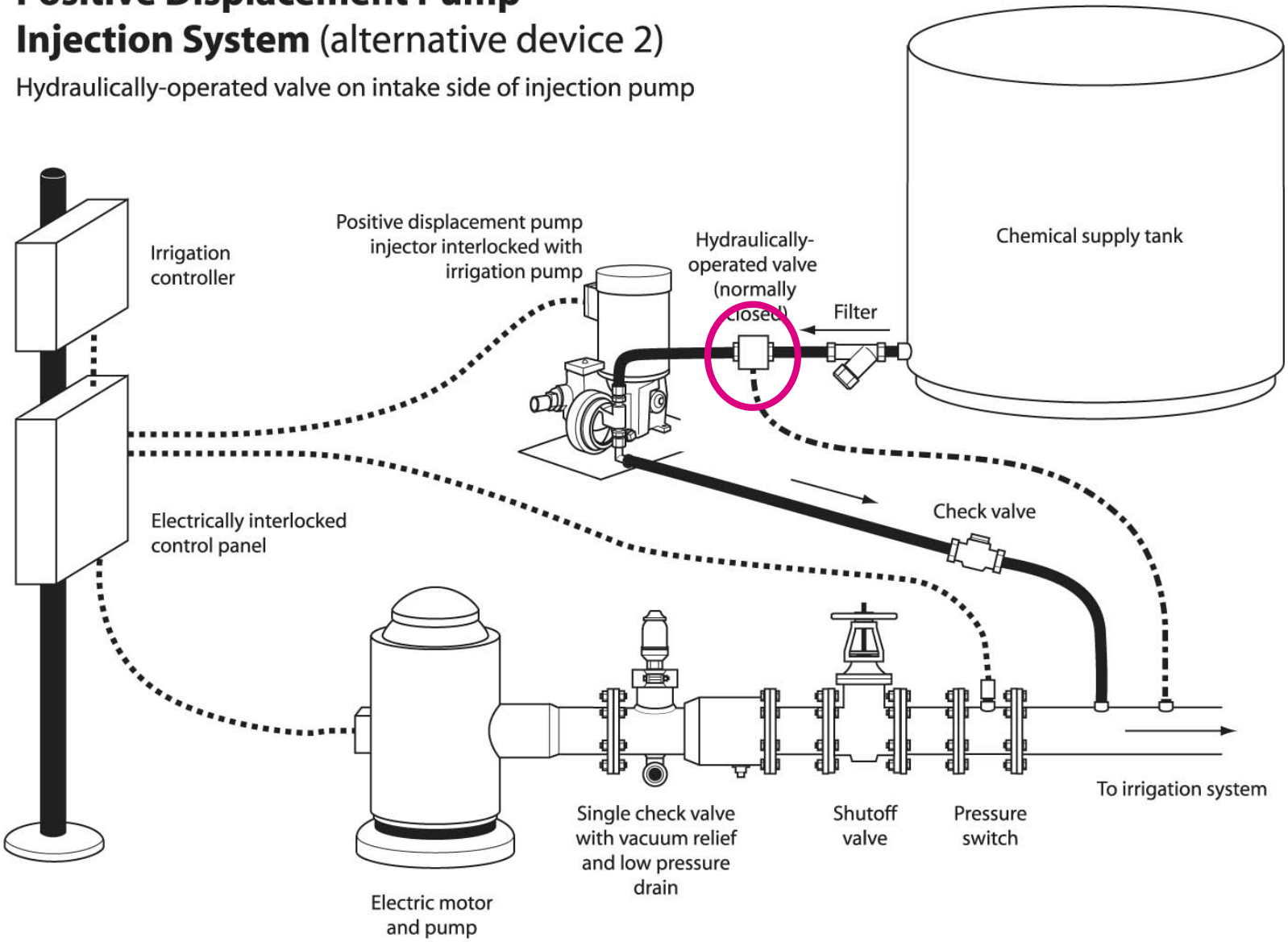
This valve would only open when the main water line is adequately pressurized.

Positive Displacement Pump Injection System



Positive Displacement Pump Injection System (alternative device 2)

Hydraulically-operated valve on intake side of injection pump



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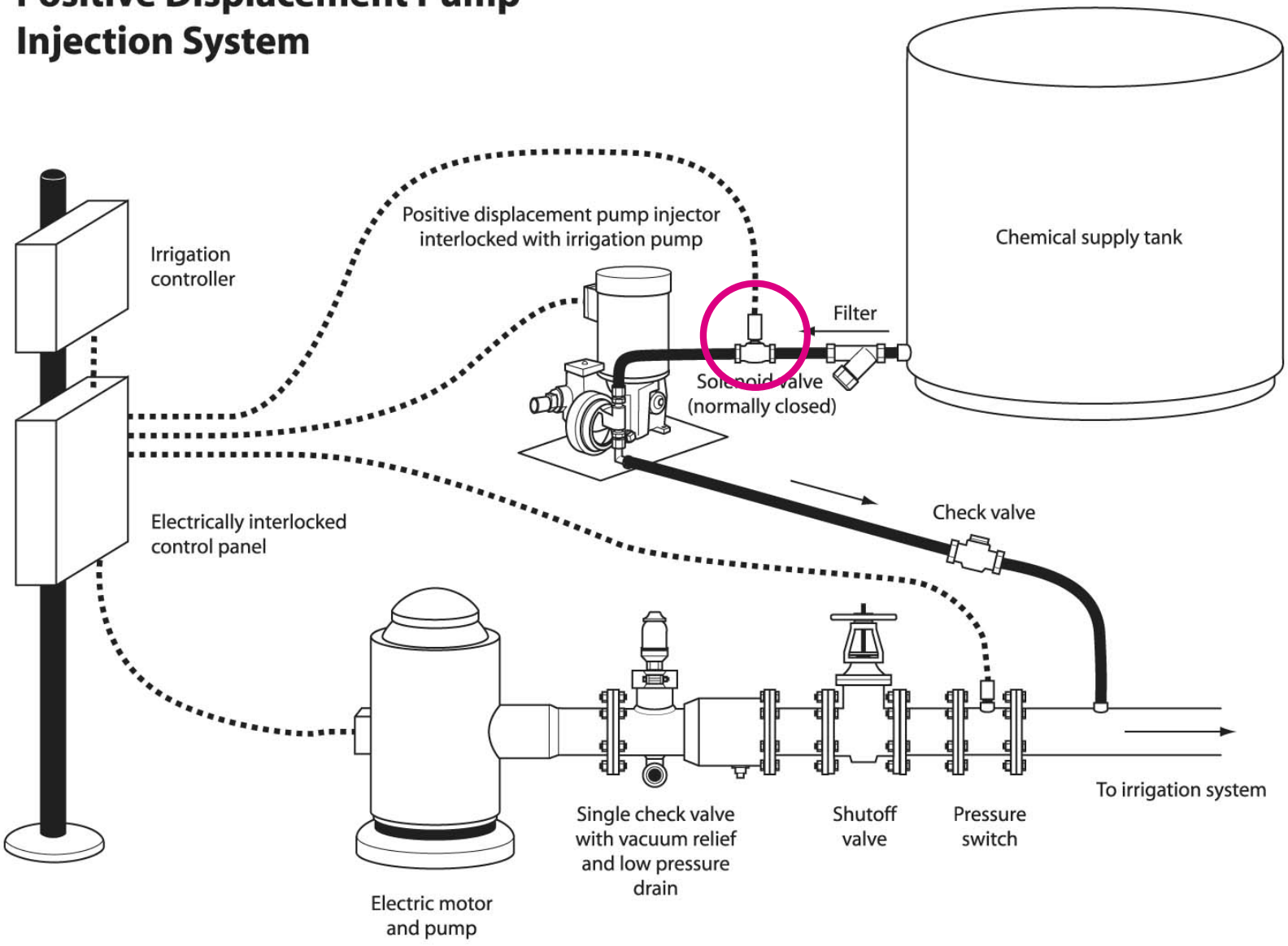
Alternative devices:

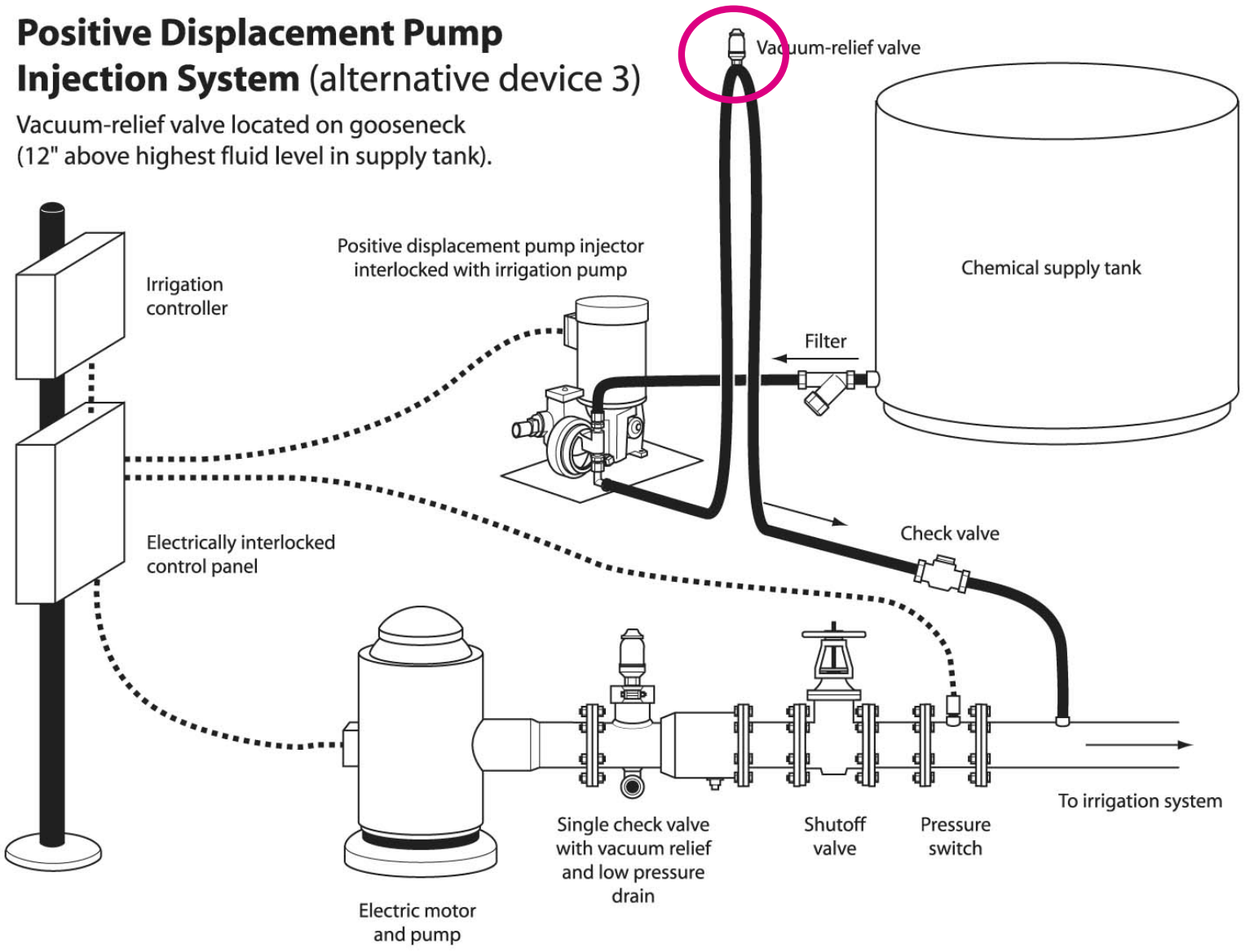
Replacing the normally-closed solenoid valve on the injection pump line with a "*functional vacuum relief valve located in the pesticide injection line between the positive displacement pump and the check. This valve must be elevated at least 12 inches above the highest fluid level in the pesticide supply tank and the highest point in the injection line*".

Positive Displacement Pump Injection System



Positive Displacement Pump Injection System (alternative device 3)

Vacuum-relief valve located on gooseneck
(12" above highest fluid level in supply tank).



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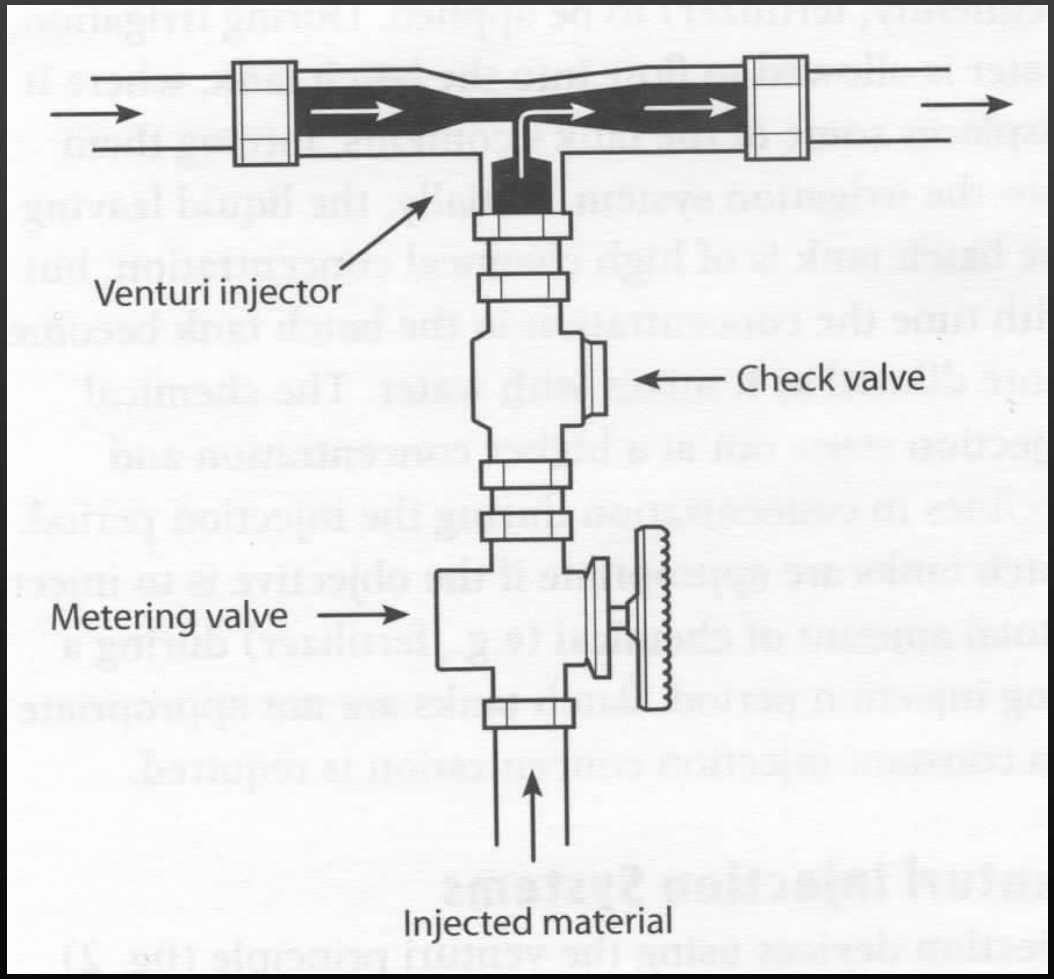
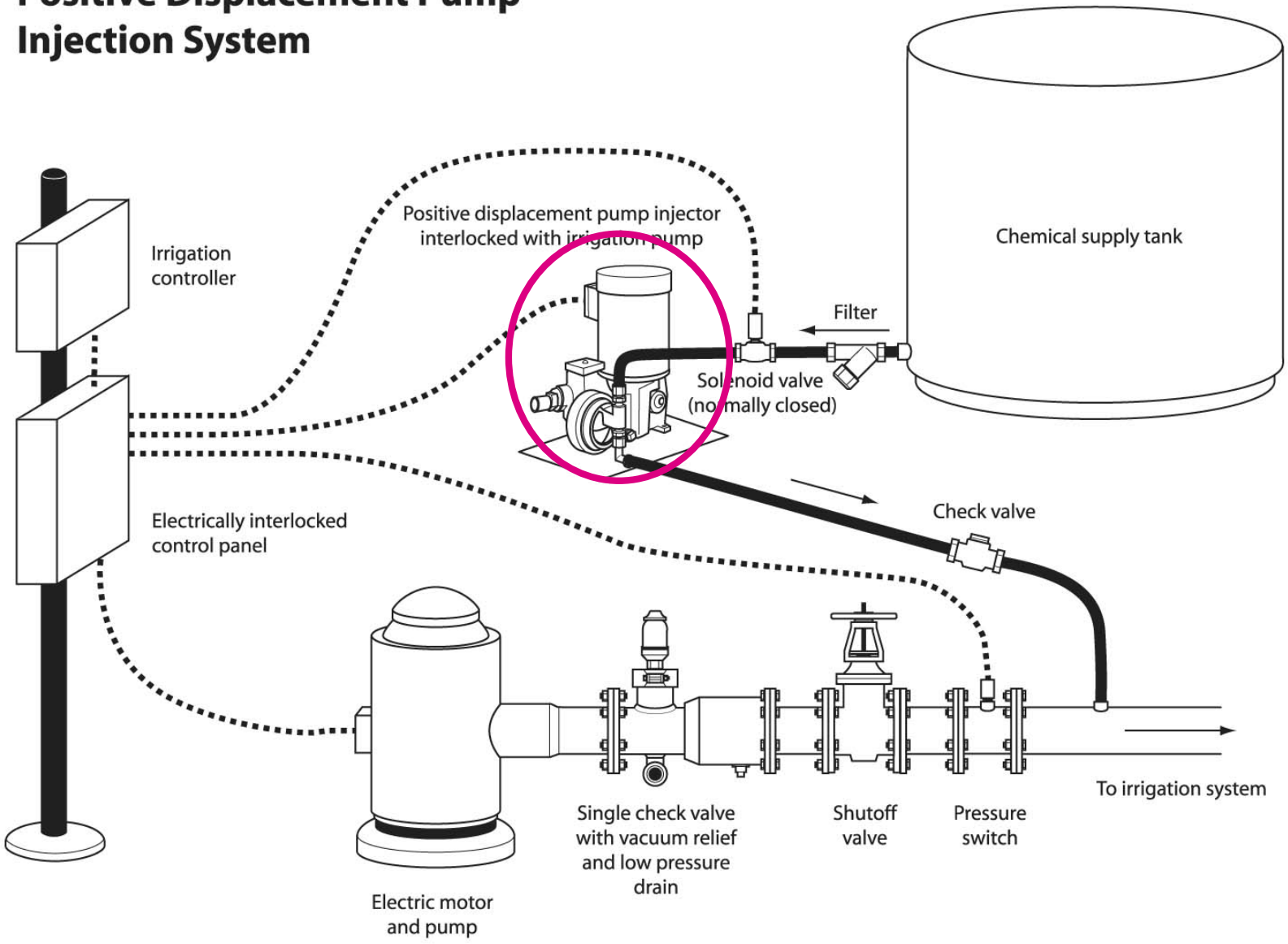
Alternative devices:

Replacing the positive displacement injection pump with "*a venturi system inserted directly into the main water line. The line from the pesticide supply tank to the venturi must contain a quick-closing check valve. This supply line must also contain either a (1) normally-closed, hydraulically operated valve, or (2) a normally-closed solenoid valve, interlocked to the irrigation pump*".

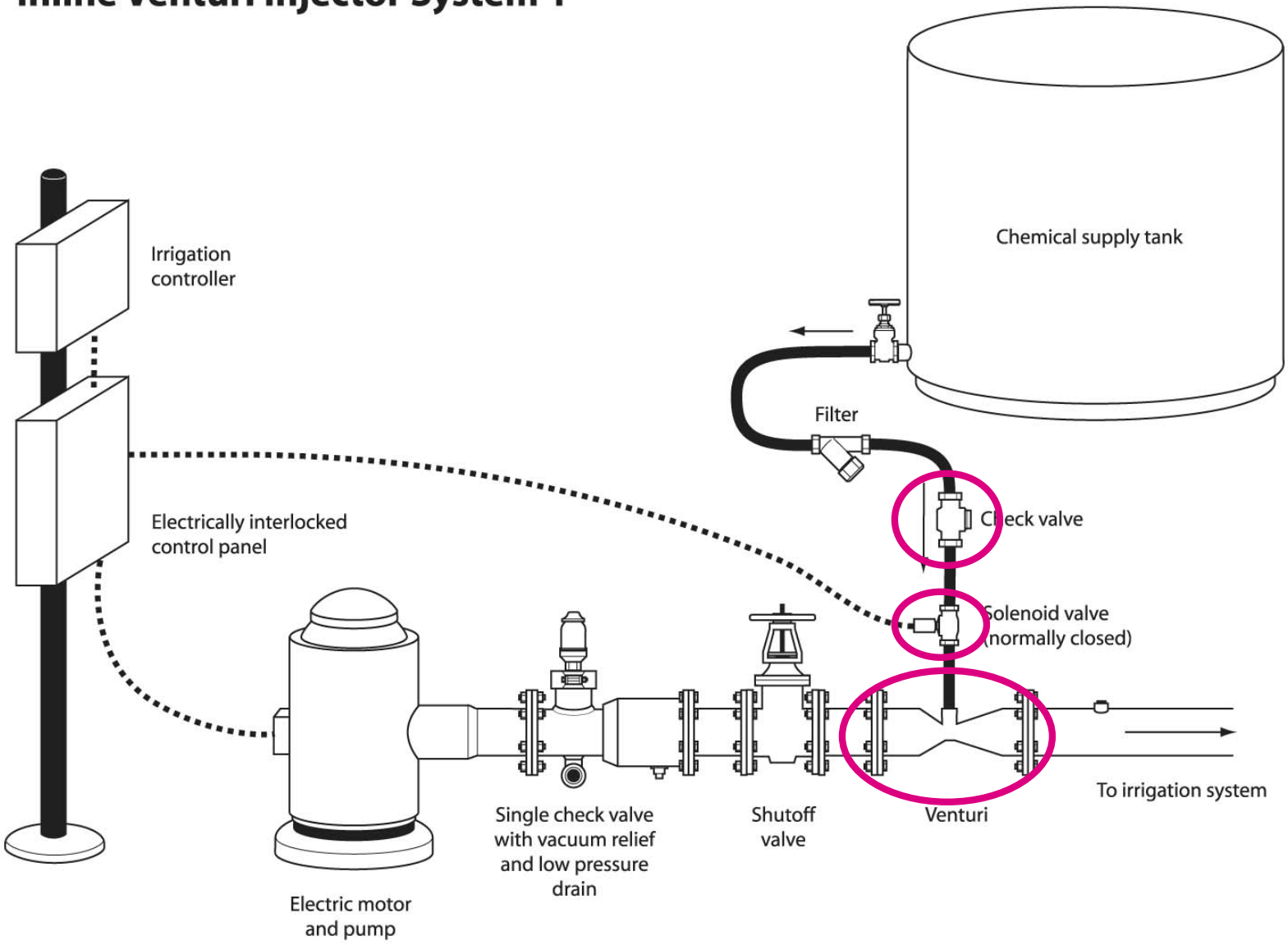
Venturi Injector:



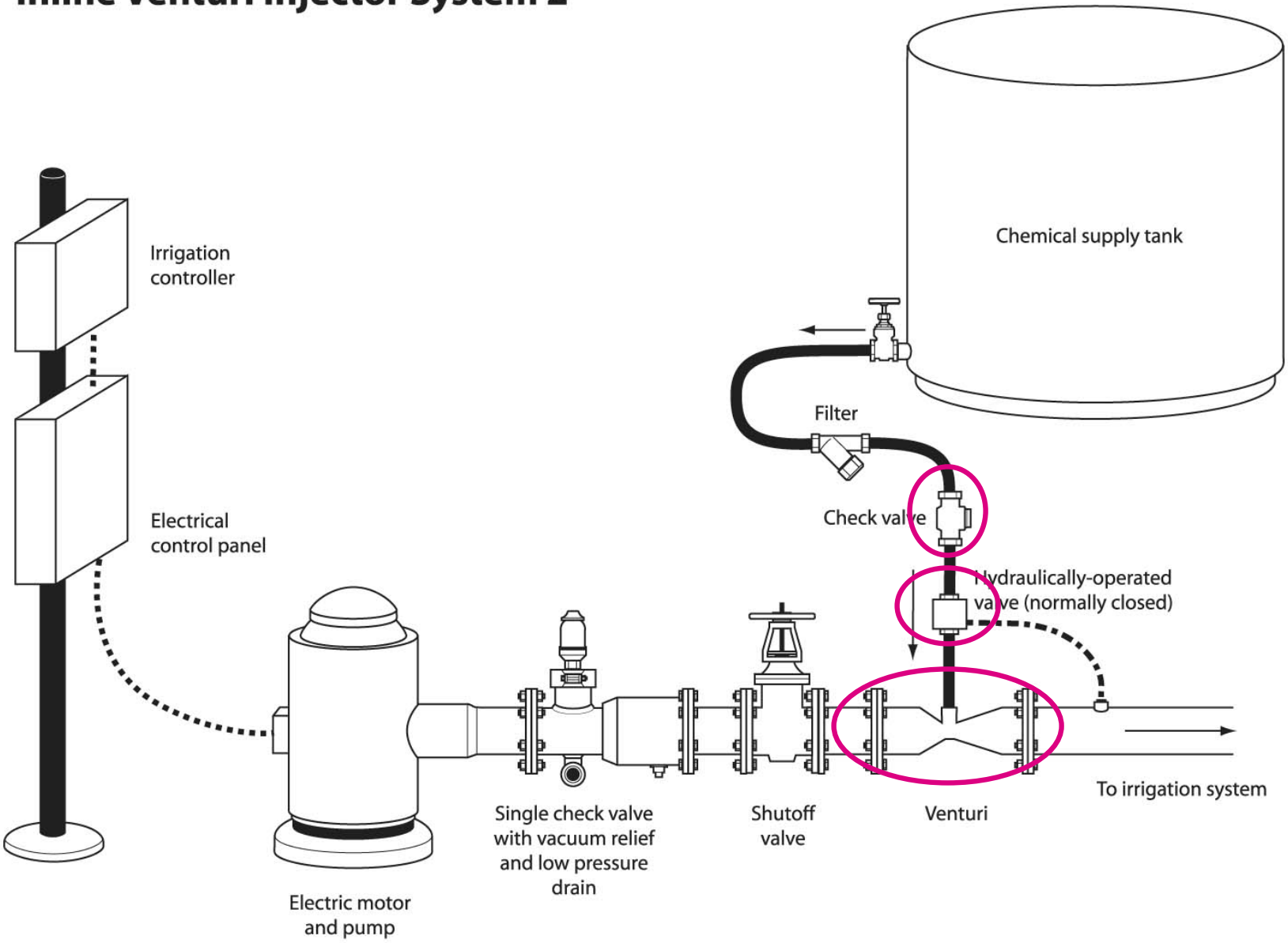
Positive Displacement Pump Injection System



Inline Venturi Injector System 1



Inline Venturi Injector System 2



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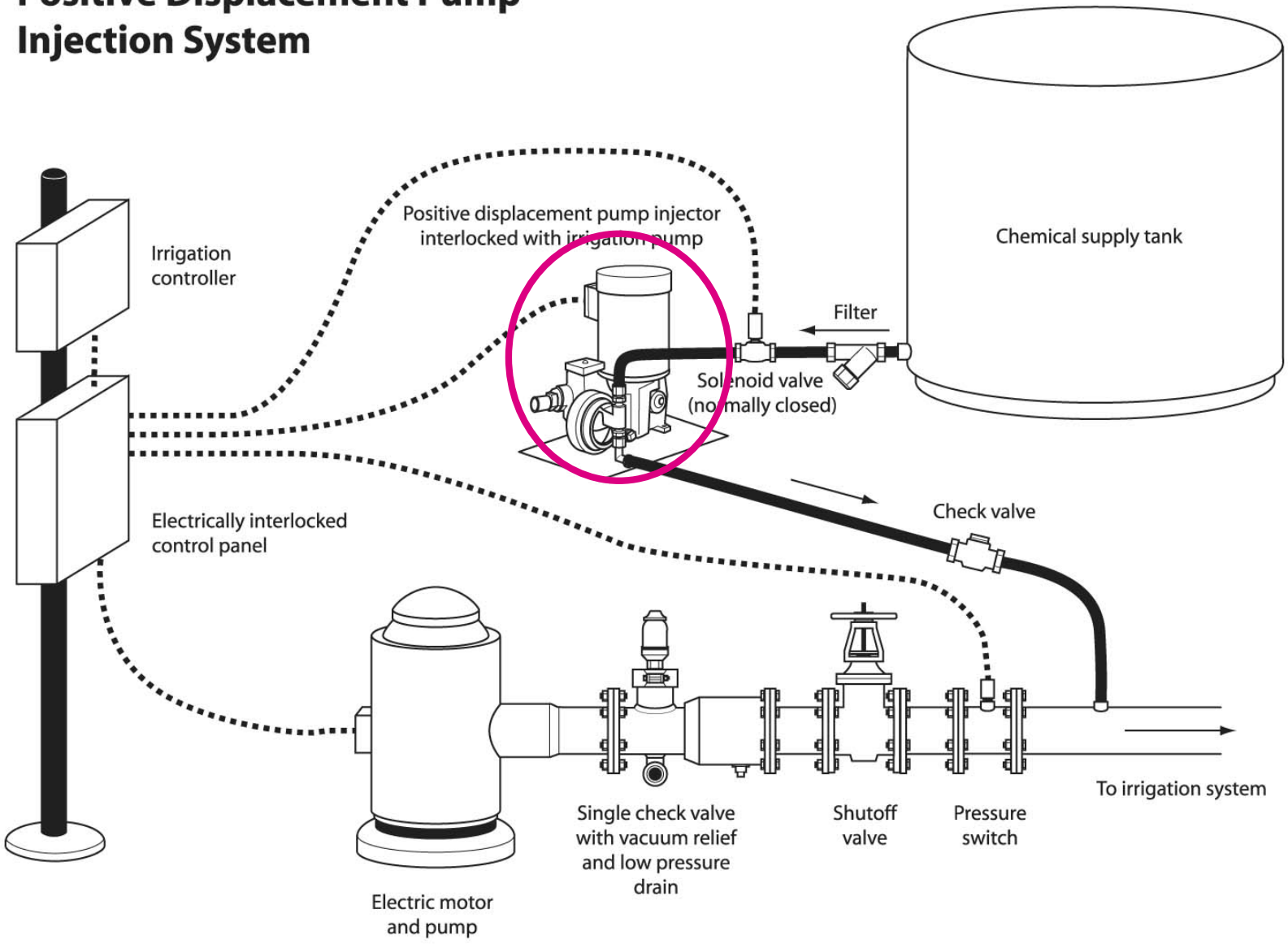
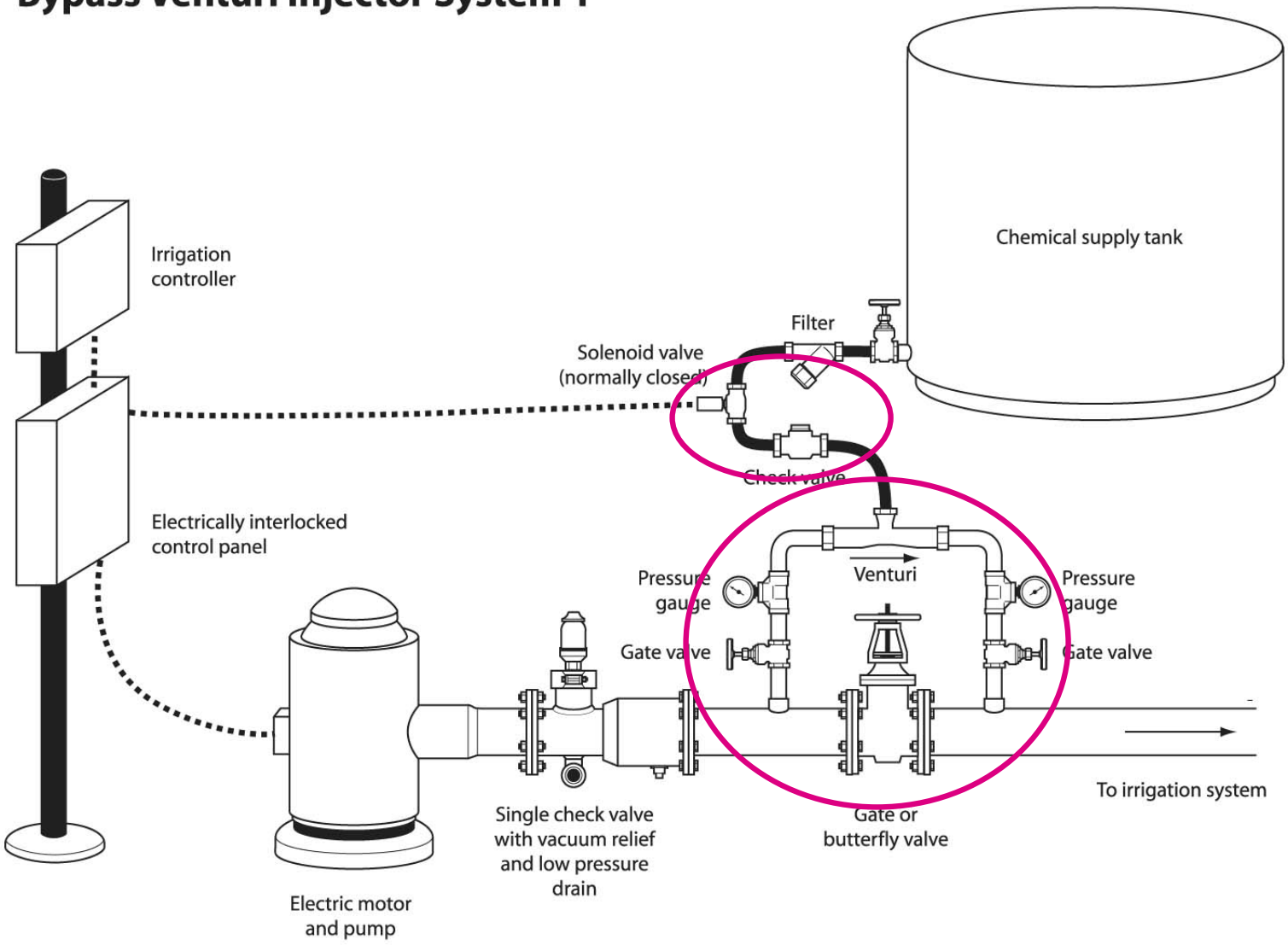
Alternative devices:

Replacing the positive displacement injection pump with "*a bypass venturi injector*". The same requirements for valves on the intake line to the venturi injector hold for both the inline venturi injector system and for the bypass venturi injector system.

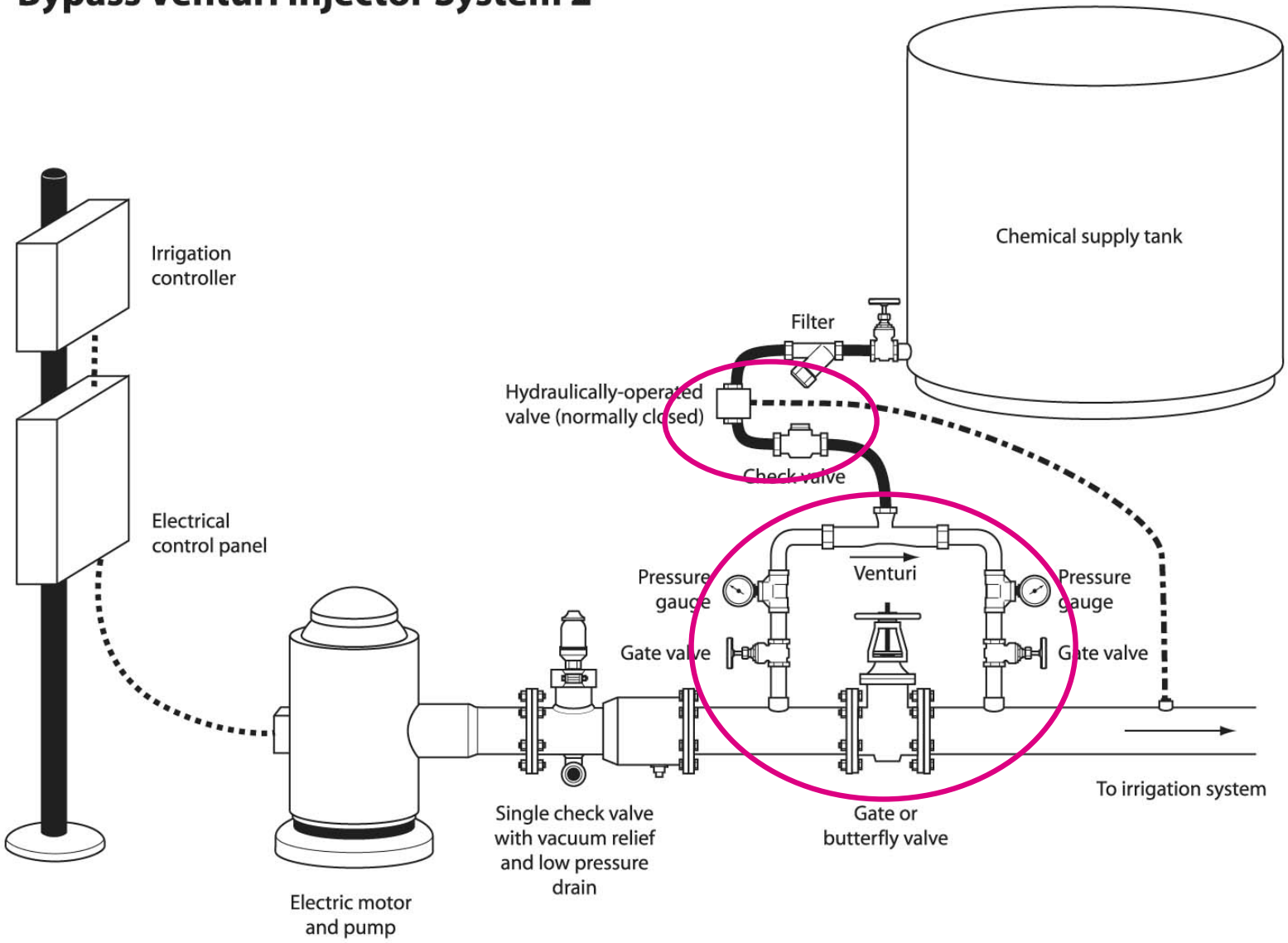
Positive Displacement Pump Injection System



Bypass Venturi Injector System 1



Bypass Venturi Injector System 2



Venturi Injector - Bypass Across a Pressure Drop

Venturi Injector

- The bypass venturi injector must be plumbed across a pressure drop in order to work.
- There is approximately a 20% pressure loss across the venturi.
- The venturi injector can sometimes be difficult to adjust for a constant injection rate, especially if the irrigation system pressure is fluctuating or changes (different irrigation blocks being irrigated).

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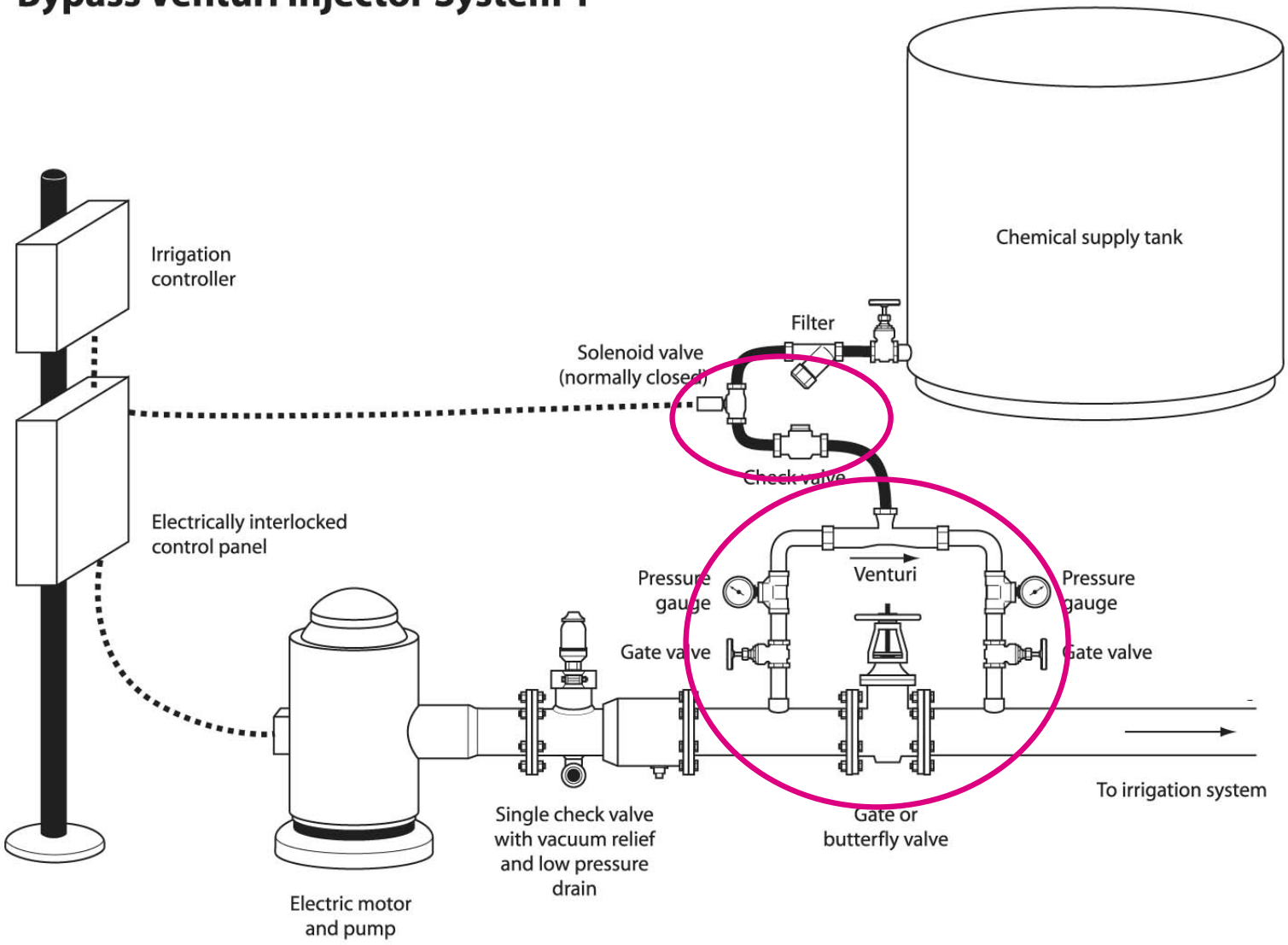
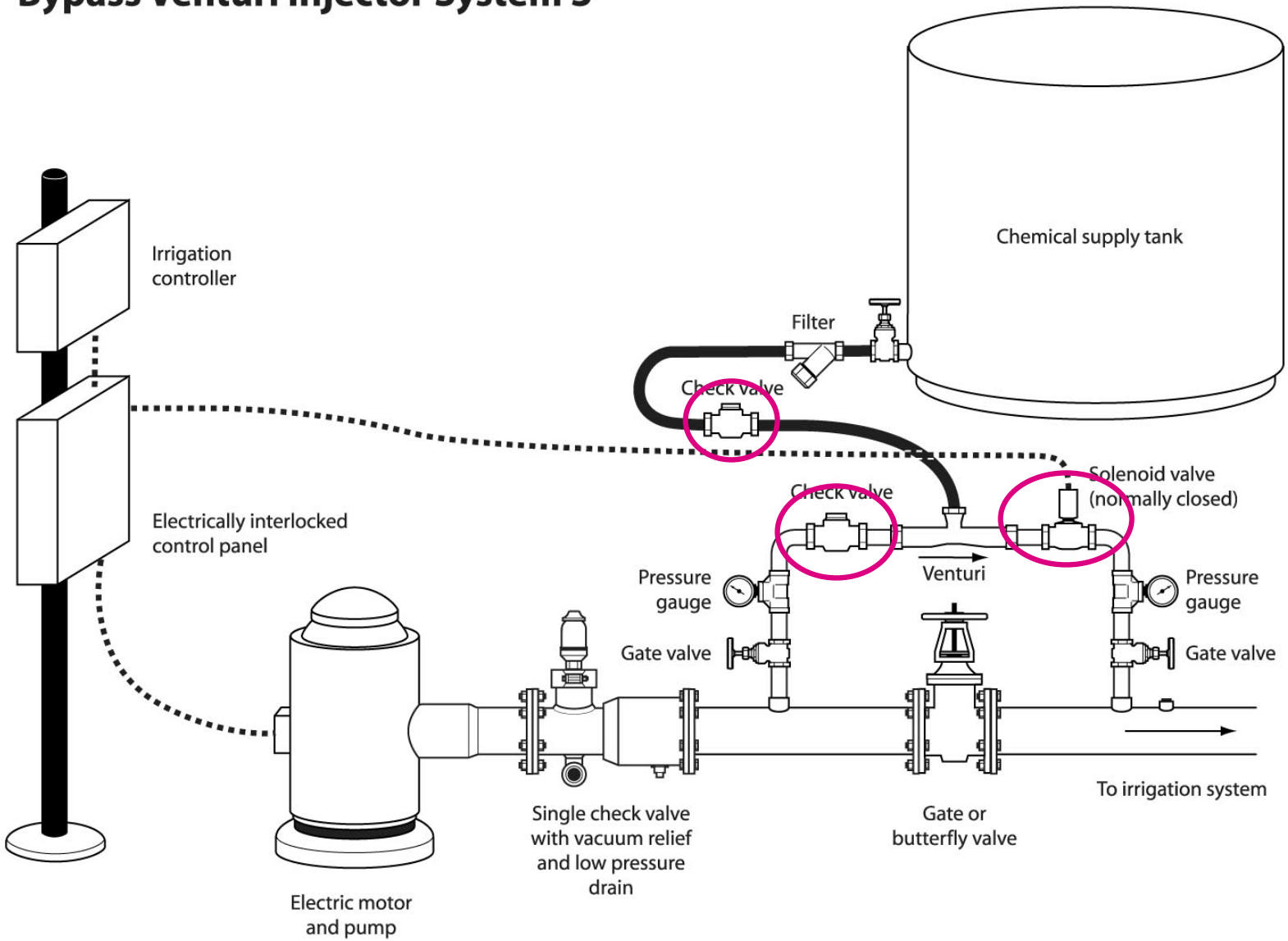
Alternative devices:

Replacing the positive displacement injection pump with "*a bypass venturi injector*". Instead of the valves in the line from the pesticide tank to the venturi, install a check valve upstream of the venturi and either a normally closed solenoid or a normally closed hydraulically operated valve downstream of the venturi injector.

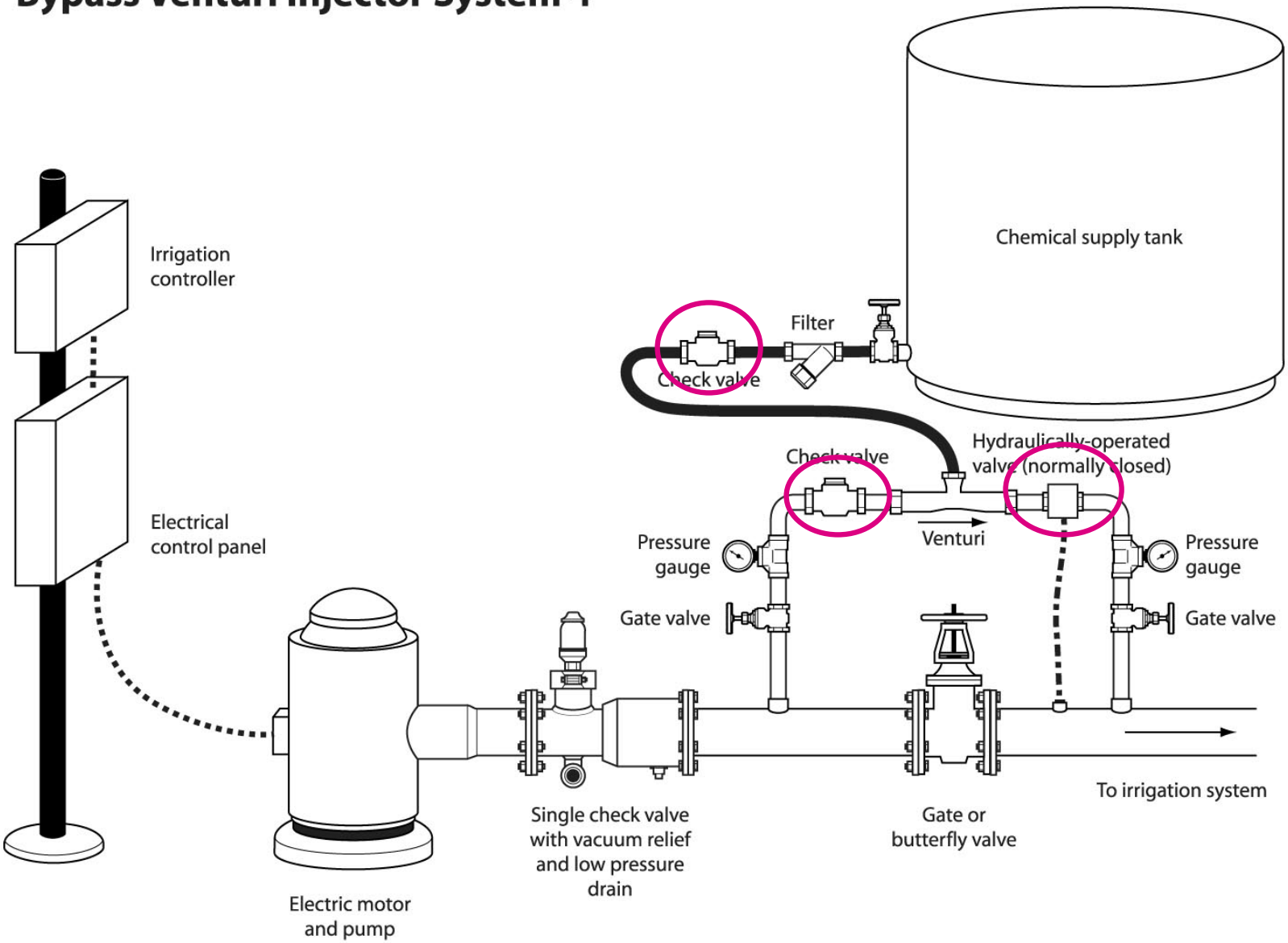
Bypass Venturi Injector System 1



Bypass Venturi Injector System 3



Bypass Venturi Injector System 4



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Alternative devices:

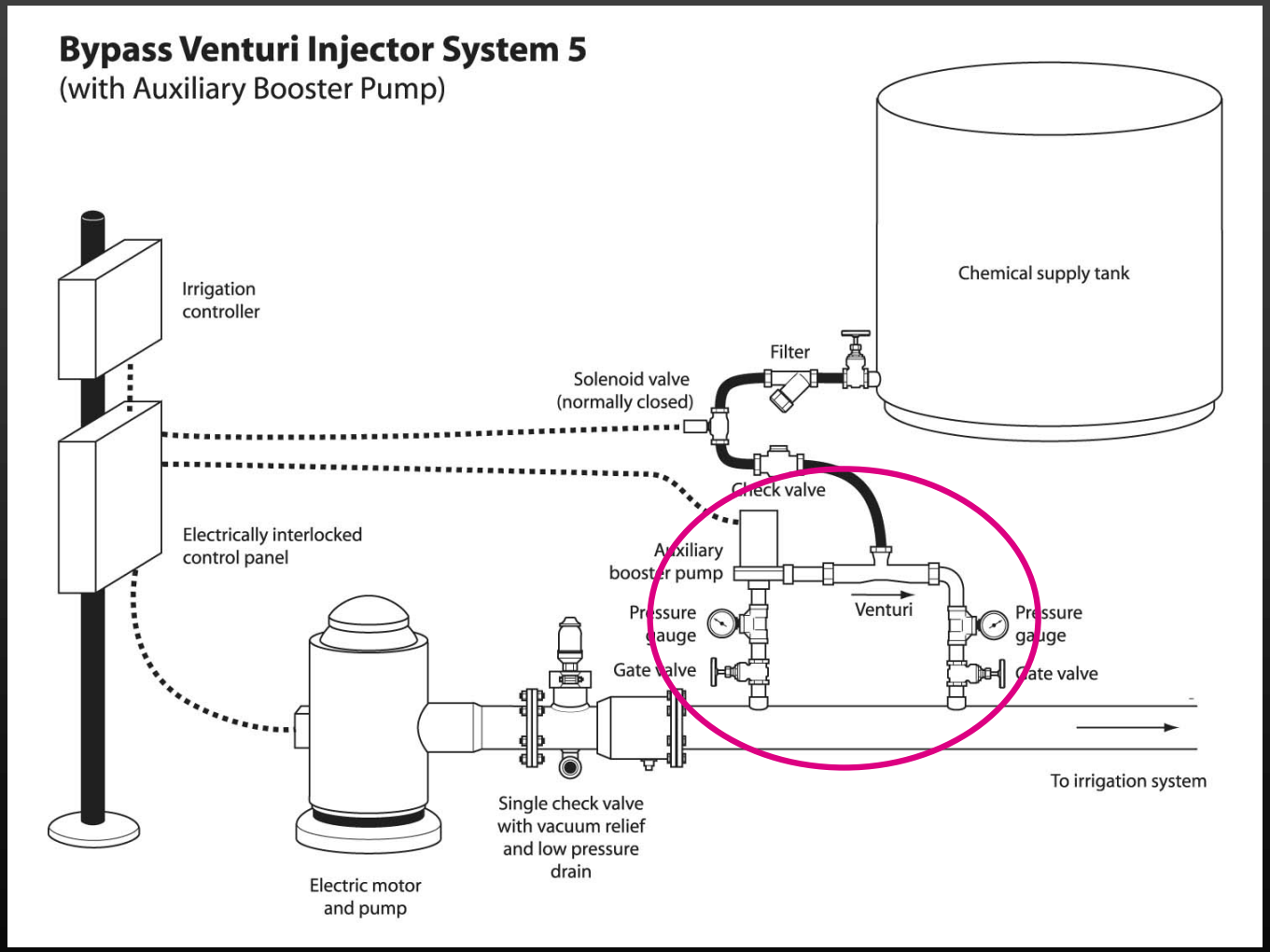
The bypass venturi system can also be installed using a *booster pump*.

With a booster pump venturi system, the venturi does not need to be installed across a pressure drop.

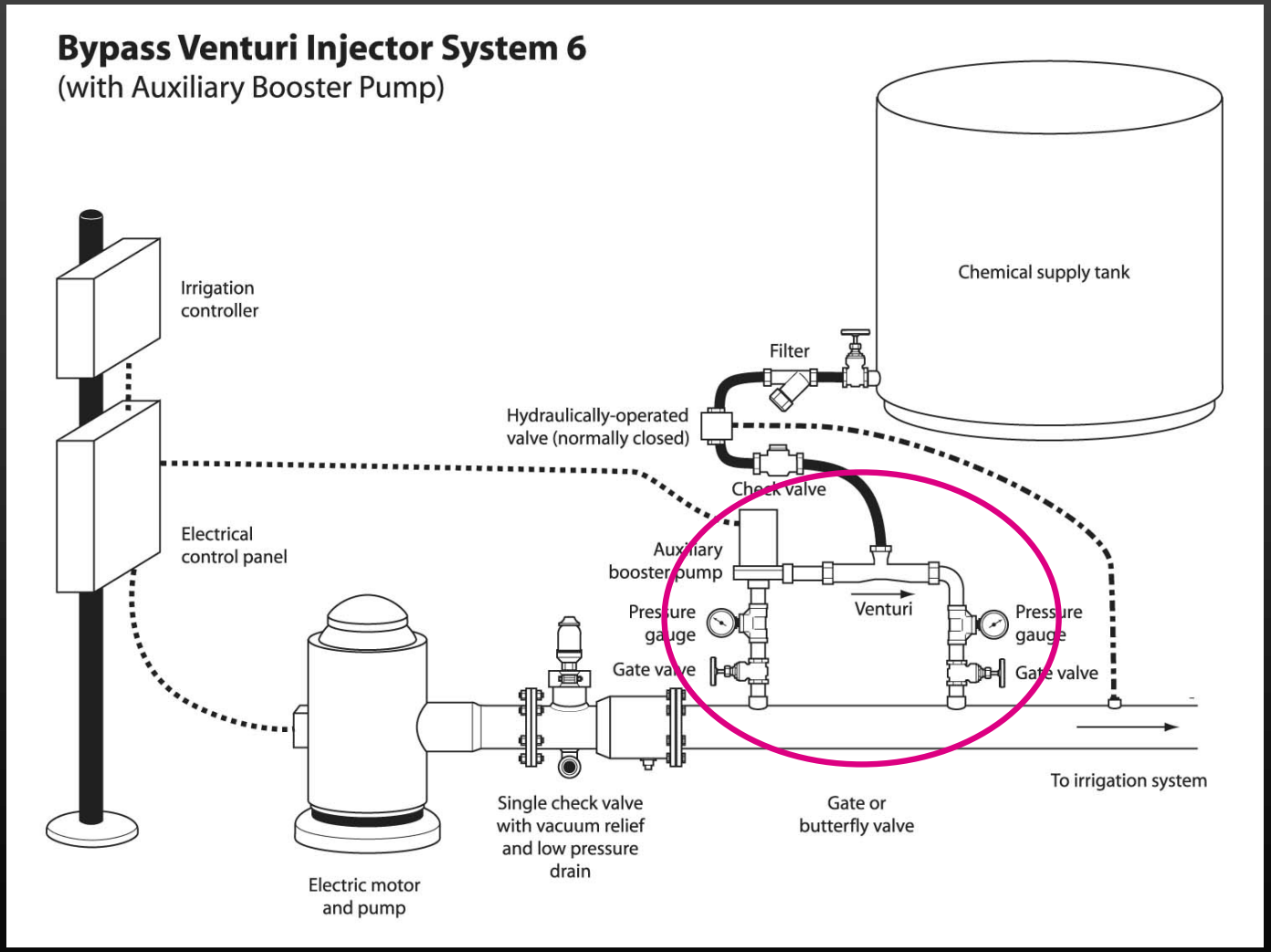
With a booster pump system, the venturi system is more easily controlled and not as sensitive to changes in the irrigation system pressure.

Venturi Injector - Bypass with a Booster Pump

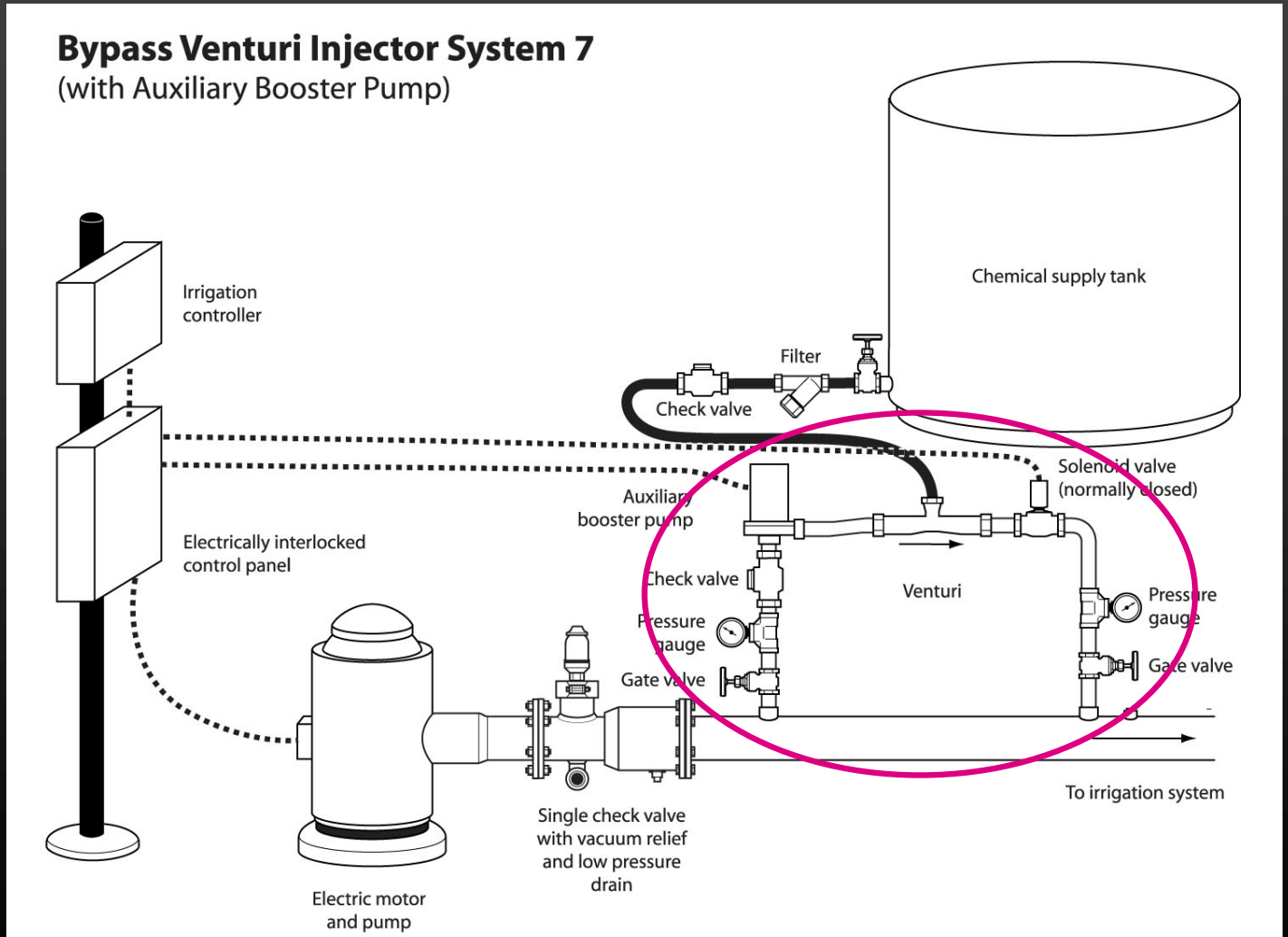
Venturi Booster Pump Injection System



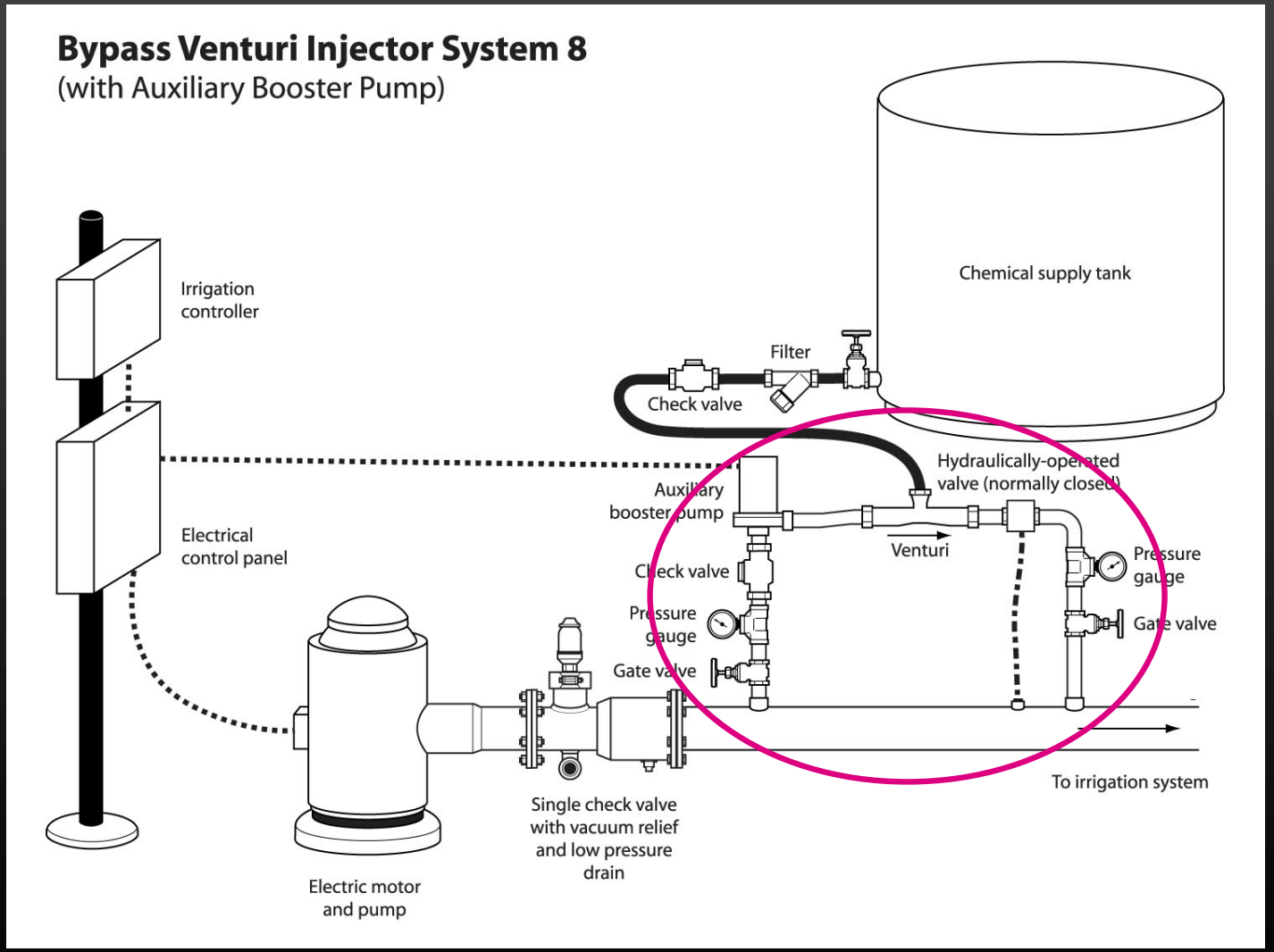
Venturi Booster Pump Injection System



Venturi Booster Pump Injection System



Venturi Booster Pump Injection System



Chemigation Safety

Summary:

- **Proper injection equipment is the first step in complying with injection safety requirements.**
- **It is effective in protecting the water supply, preventing chemical spills, and ensuring that injections occur when the irrigation system is operating properly.**
- **Check local regulations, especially for backflow prevention, to see if they exceed the label requirements.**