DEPARTMENT OF HEALTH

Chlorine Disinfection - Equipment

NONCOMMUNITY PUBLIC WATER SUPPLY PROGRAM

Types of Chlorine

Chlorine can come in several forms, including liquid bleach (sodium hypochlorite), gas chlorine, and solid calcium hypochlorite. When combined with water, all of these forms of chlorine produce the same active chemicals and react with microorganisms in the same manner.

Gas chlorine is a highly pure, elemental form of chlorine and is commonly used in large water treatment plants. The gas is stored in pressurized cylinders and slowly released though automatic valves and feed lines into the water supply. Gas chlorine systems are efficient and well suited to large applications, but they also present several safety hazards that must be addressed though engineered and administrative controls, such as ventilation, alarms, standard operating procedures, and well-trained operators.

Liquid chlorine, also called bleach or sodium hypochlorite, is the most commonly used form of chlorine for small water systems. It is widely available in one to five gallon containers as well as in bulk quantities with concentrations ranging from 5-20%. While the use of liquid chlorine still requires safety precautions such as spill containment and use of personal protective equipment (PPE), it is generally regarded as less hazardous and easier to handle than gas chlorine.

Solid calcium hypochlorite is most commonly used for manually disinfecting or shocking pools and wells. MDH does not typically allow the use of solid calcium hypochlorite feed systems for continuous disinfection of a potable water supply.

Regardless of the type, all chlorine products must be safe for use in potable water supplies. Chemicals intended for use in potable water supplies should be certified to ANSI/NSF Standard 60. Liquid bleach products intended for laundry use or those that contain scents or splash-less additives should never be used for drinking water applications. If you are unsure if the chlorine you are using meets these criteria, contact MDH.

Chlorine Feed Systems

Liquid chlorine feed systems consist of a chemical storage tank, a feed pump, and feed lines leading up to the injection point into the water supply. Gas chlorine systems are more complex and are not covered in this document. Design of gas chlorine systems should be handled by a qualified engineer or water treatment specialist and should follow appropriate industry standards, such as those found in Recommended Standards for Water Works (10 States Standards).

There are two primary types of liquid chemical feed pumps: peristaltic and diaphragm pumps. A peristaltic pump, shown in Figure 1, consists of a rotary motor that spins several rollers around a length of tubing. As the rollers pinch the tubing, it forces liquid through in the direction of the motor rotation. This pinching creates suction which continues to draw liquid from the storage tank. Peristaltic pumps can operate at a single speed or can have adjustable speed to

modify the chlorine dose. A diaphragm pump, shown in Figure 2, consists of a pump chamber with a flexible diaphragm attached to a piston and two check valves. The piston pulls the diaphragm back to create suction, then pushes the diaphragm to force the chlorine from the pump chamber to the injection point. The dosing rate of a diaphragm pump is controlled by two settings: the stroke length (how far the piston pulls the diaphragm back) and the stroke speed (how frequently the piston cycles back and forth). Generally, a low stroke length and high stroke speed provides the most consistent chlorine feed. Chlorine feed pumps should be wired to a pump, pressure switch, float, flow sensor, or solenoid valve such that it only doses chlorine into flowing water. To ensure that a reliable and correct dose of chlorine is provided, manual operation of feed pumps should be avoided. If the chlorine feed pump is wired to a pressure switch, the injection point should be located upstream of the pressure tank.

Figure 1: Peristaltic Pump

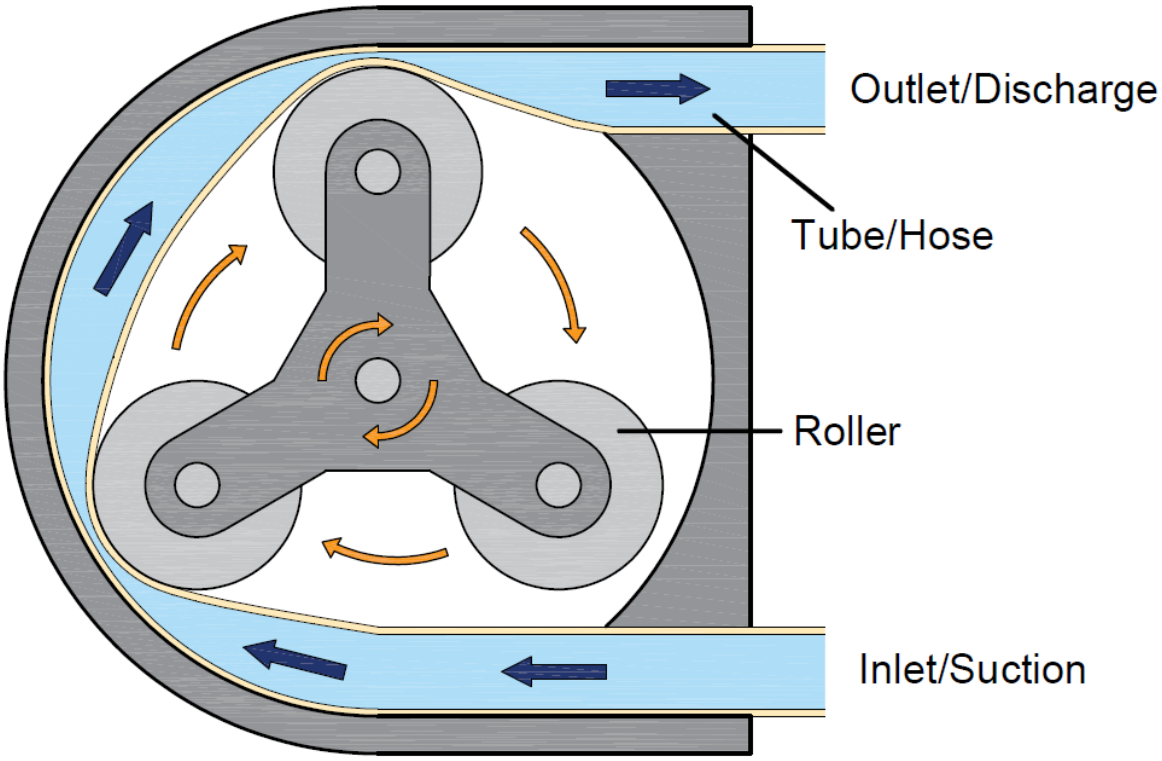
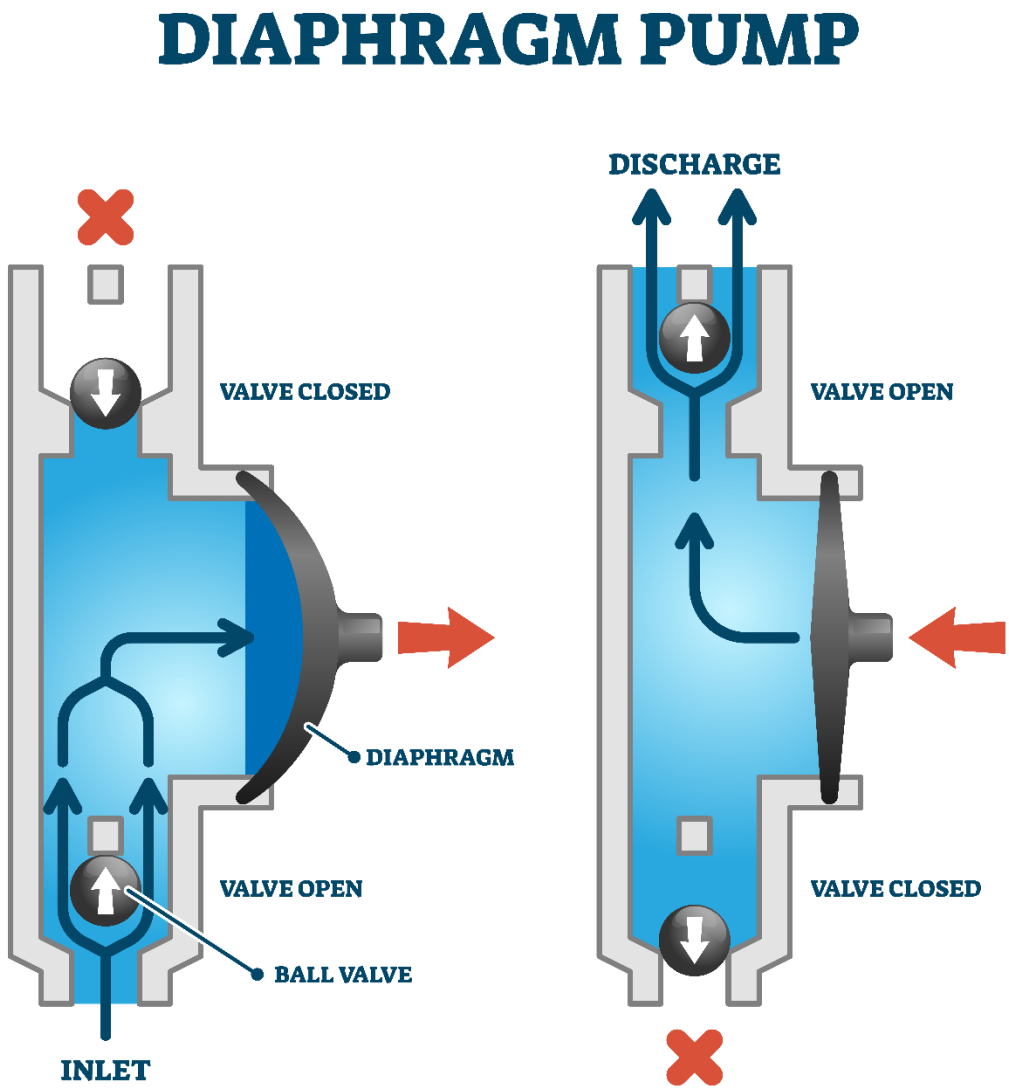


Figure 2: Diaphragm Pump



Troubleshooting Common Issues

There are several common issues associated with chlorine feed equipment. A troubleshooting table is provided at the end of this document.

Equipment issues are often caused by the corrosiveness of bleach products. For peristaltic pumps, the tubing inside the pump housing will eventually dry up and crack. If this happens, the pump will appear to be operating, but chlorine will not be drawn from the storage tank or injected into the plumbing. A leak may be observed inside the pump housing. Replacing the tube resolves the issue. For diaphragm pumps, the check valve seats or the diaphragm may degrade over time, resulting in the pump being unable to gain suction or force chlorine through the feed line. These components can be replaced by taking the pump housing apart. No matter what type of feed pump is used, it is always recommended to have a repair kit and extra components on hand.

Chlorine Safety

Chlorine chemicals are harsh, corrosive, and pose potential health risks to the operator if not handled properly. Always follow all safety protocols listed on the chemical's Safety Data Sheet (SDS) and use appropriate personal protective equipment (PPE) such as gloves, safety goggles, and a respirator. Ensure that adequate administrative and engineered controls are in place, such as ventilation, spill containment, and standard operating procedures. **Never mix liquid chlorine (bleach) with acids such as ammonia**; this will form toxic chlorine gas which can be life threatening.

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01/21/25

To obtain this information in a different format, call: 651-201-4700.

Troubleshooting Low Chlorine Residual

Cause	Indications	Solution
Low water usage	The water meter reading hasn't changed. The water storage tank level hasn't changed. The feed pump hasn't been heard running. There are very few people on-site using water.	Flush system until required residual is achieved
Broken roller tube (peristaltic pumps only)	The pump runs but the chlorine level in the feed tank doesn't go down. Leaks or puddles under the pump motor.	Replace roller tube
Broken diaphragm or check valve seats (diaphragm pumps only)	The pump runs but the chlorine level in the feed tank doesn't go down. The pump won't prime.	Replace component
Broken discharge line	The pump runs and chlorine level in the feed tank goes down. Leaks or puddles under the discharge line.	Replace discharge line
Broken suction line	The pump runs but the chlorine level in the feed tank doesn't go down. Air bubbles are visible in the suction and/or discharge lines. No leaks or puddles. Other pump components are in good condition.	Replace suction line
Old bleach	The pump runs and chlorine level in the feed tank goes down. The pump speed needs to be increased or the chemical tank needs filling more frequently. The bleach is older than 3 months.	Refill chemical tank with new bleach
Clogged injection point	The pump runs and the chlorine level in the feed tank may or may not go down. Leaks or puddles under injection point.	Clean or replace injection quill
Chemical tank is low/empty	The pump runs. The level of chemical in the feed tank is at or near the bottom.	Refill chemical tank
Residual is >20 mg/L	When measuring residual, the DPD reagent flashes a dark color that quickly disappears. The pump runs and chlorine level in the feed tank goes down. You have increased the pump speed or refilled the feed tank recently. The water smells/tastes like chlorine.	Flush entire system and reset pump speed to regular level
Electrical issue	The pump does not run.	Check power to pump and pressure switch. Consult electrician.