Chlorination of water mains

Emond Plumbing and Heating

Chlorinating the water mains in a building is a multi-step process required for a new plumbing system.
This procedure requires careful planning, proper safety measures, and coordination.
Upon completion water samples must be delivered for testing within 24 hours of taking the sample.
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Step 1: Prepare the system

1. **Notify all occupants.** Post notices and inform all building occupants that the water supply will be shut off and is unsafe to use.
2. **Inspect and repair.** Conduct a thorough inspection of the entire plumbing system. All repairs must be completed before starting the disinfection process.
3. **Disconnect sensitive equipment.** Bypass or disconnect any water treatment devices.
4. **Shut off the water supply.** Turn off the main water valve to the building, secure the valve to prevent accidental reopening.
5. **Drain the system.** Open faucets and flush toilets on upper floors to relieve pressure.
6. **Isolate the hot water system.** Shut off the power/gas and close the valves to the water heater to prevent damage from the chlorinated water.
7. **Isolate water closet.** Close the valves to the water closet to prevent damage from the chlorinated water.

Step 2: Introduce the chlorine solution

1. **Calculate the dose.** You will use a solution, typically 5–6% sodium hypochlorite, diluted with water. The American Water Works Association (AWWA) and International Plumbing Code (IPC) recommend either:
    - **Low dose/long contact time:** 50 parts per million (ppm) for 24 hours.
    - **High dose/short contact time:** 200 ppm for 3 hours.
2. **Prepare the injection setup.** Use a transfer pump to inject the chlorine solution into the water system at a designated injection point, usually at the water main low point drain.
3. **Fill the pipes.** Introduce the chlorinated water into the system and open the faucets, one at a time, starting from the lowest point and working your way up.

   Run water until your test strip turns purple. This ensures the solution has reached all parts of the system.

Step 3: Wait and flush

1. **Hold the solution.** With the faucets closed, allow the chlorine solution to stand in the pipes for the required contact time (e.g., 3 or 24 hours).
2. **Flush the system.** After the contact time has elapsed, flush all chlorinated water from the system by opening faucets and flushing toilets.
3. **Dechlorinate the wastewater.** Wastewater should not be discharged directly into the environment without dichlorination.
4. **Continue flushing.** Flush all indoor faucets and fixtures until the chlorine odor is gone. You may need to clean faucet aerators to remove any dislodged debris.

Step 4: Test and restore service

1. **Test for safety.** After thoroughly flushing the system, collect water samples and have them tested by a certified laboratory for coliform bacteria and chlorine residual. Samples must be tested within 24 hours of being taken. Do not consume the water until "clean" test results are received.
2. **Retest if necessary.** If testing shows the presence of bacteria, the entire chlorination procedure must be repeated.
3. **Reactivate equipment.** Once the system is confirmed safe, reconnect all water treatment devices, water closets and water heaters that were previously bypassed.

Safety precautions

- **Use personal protective equipment (PPE).** Wear gloves, goggles, and protective clothing when handling concentrated bleach.
- **Ensure proper ventilation.** Work in well-ventilated areas to avoid inhaling chlorine fumes.
- **Never mix bleach with other chemicals.** Combining chlorine with ammonia, for example, can produce highly toxic gases.
- **Have eye and wash stations available.** In case of contact, have emergency wash stations ready.
- **Have a plan for alternative water.** Provide occupants with bottled water during the treatment and testing period.
- **Work with a partner.** Have at least two trained individuals performing the chlorination.

Correct pump for chlorination.
Blue Angel EC50K

- **Utility Pump Transfer 1450 Gallons per Hour 1/2 Horsepower 115 Volt**

Purchase from Ferguson. (2) 60 in. 304 Stainless Steel washer Hose Part #PF146815 Item #2405283
Clothesline Fresh® Chlorine Bleach 4 5 gal Chlorine Bleach Part #S700405 Item #7480930
This is standard bleach and you will need to double the amount used

Purchase from Grainger. LAMOTTE Test Strip: 10 to 200 ppm Total Chlorine, 200 Tests Item 4EWC7 Mfr. Model 4250-BJ
Sodium Hypochlorite 12.5 Solution, 5 Gal Item 810Z23 Mfr. Model 11934 (2 week lead time)

Method- chlorination consists of calculating the number of gallons of sodium hypochlorite required to disinfect a
water main to a concentration of 50 mg/L (PPM).

• **Example:** Determine the amount of sodium hypochlorite required to disinfect 1100 lf. of 8" pipe and 4800 lf. of 12" pipe using 12.5% solution.

1. Use link to calculator to determine pipe volume.
Pipe volume calculator:
https://www.vcalc.com/wiki/pipe-volume

Example:
8" pipe = 2.611 gallons per 1 foot length
12" pipe = 5.876 gallons per 1 foot length

2. Determine concentration of available chlorine required
(usually 50 ppm is minimum standard).

1% of a million = 1 ppm = 10,000 in 1,000,000

3. Determine percentage of chlorine available in sodium hypochlorite being used.
Note: Clorox™ is 5.25% available chlorine- Supershock™ is 12.5% available chlorine

4. Determine volume of water to be chlorinated:
1100 LF of 8" pipe × 2.611 gal./ft. = 2,872 gal.
4800 LF of 12" pipe × 5.876 gal./ft = 28,204 gal.
Total Pipe Volume: = 31,076 gallons

5. Calculate amount of 12.5% sodium hypochlorite required.

Formula:
x = Gallons of sodium hypochlorite required.
x = Required ppm chlorine × Volume of pipe in gals.
% of chlorine used × 1 part of 1,000,000

Where:
Required ppm chlorine = 50 PPM
% of chlorine used = 12.5%
Volume of pipe = 31,076 gallons
1% (1,000,000) = 10,000

$x = \frac{50 \times 31{,}076 \text{ gal.}}{12.5 \times 10{,}000} = 12.43 \text{ gal. required}$

If using standard chlorine from Ferguson calculate at 6% (total- 25.89 gallons)

Effects of chlorine on aluminum anode rods

- **Faster degradation:** High levels of chlorine in the water supply can cause aluminum anode rods to break down much faster than they normally would.
- **Gel-like residue:** An aluminum anode rod reacting with high chlorine levels can produce aluminum hydroxide, a clear, gray, or bluish gel or bead-like substance that can clog plumbing fixtures.
- **Foul smell:** The combination of an aluminum anode and chlorinated water can sometimes promote the growth of sulfur-reducing bacteria, resulting in an unpleasant "rotten egg" smell in the hot water.

Chlorine significantly harms toilet flappers by degrading their rubber material, causing them to become brittle, warp, and lose their sealing ability, which can lead to leaks and a constantly running toilet. The extended contact with concentrated chlorine from in-tank tablets accelerates the breakdown of the flapper, leading to costly damage.

How chlorine affects flappers

- **Degrades rubber:**Chlorine is highly caustic and breaks down the rubber materials that make up the flapper.
- **Causes brittleness:**Over time, the rubber becomes brittle.
- **Warping:**The chemical can warp the flapper, compromising its ability to create a tight seal.
- **Loss of sealing:**A damaged flapper can't create a proper seal, leading to water continuously leaking from the tank into the bowl.

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