

Tech Brief

PUBLISHED BY THE NATIONAL ENVIRONMENTAL SERVICES CENTER

Valve Exercising

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Summary

Every water system has valves—devices that regulate, stop, or start the flow of water in the distribution lines. Being able to operate these valves at a moment's notice is extremely important. In an emergency, sections of a distribution system may need to be shut down without delay. However, if a valve is not used over a period of time it can seize-up from corrosion and get stuck, making the valve inoperable. This *Tech Brief* examines typical valve exercising programs that can help maintain the useful life and operation of water system valves.

Where, oh where are my valves?

Most water systems would be hard pressed to say that they know where all their valves are. Others would be happy to know where half of them are. Many systems are reluctant to take on a valve exercising program because of labor costs or the fear of needing additional tools.

While not knowing the location of a system's valves makes the job more difficult, it is not a good reason for not undertaking an exercising program. Yes, it will cost money—especially if you have to replace valves that are no longer functional—but the benefits of such a program far outweigh the negative. After all, system valves are there for a reason and if they aren't working, shouldn't they be fixed or replaced?

Some of the benefits of fully operational valves include:

- Being able to isolate a water main break, meaning reduced water loss, easier repairs, and less property damage.
- Knowing where the valves are will help locate the rest of the distribution system, which is often an issue, particularly with older utilities.
- Obtaining detailed information on the valve type and size, as well as the line where it's located.
- Having confidence the valves will last much longer.



When a water main breaks in the middle of a frigid night, you'll be glad the valves function correctly.

- Paying less overtime. If you can't isolate the leak or find the valves you can run into significant labor costs repairing those leaks in an emergency.
- Being able to isolate part of the system from a terrorist attack.

Software is available to help manage the valves in the distribution systems.



For more information about finding distribution lines, see the Tech Brief "Locating Distribution Lines" on the National Environmental Services Center Web site at www.nesc.wvu.edu.



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Getting Started

A good first step in a valve-exercising program is to prioritize the valves. The most important valves are usually those near critical customers such as hospitals. Other factors could include the amount of flow through the valve, being the oldest valve in the system, or proximity to a main intersection on a busy street. Exercise one valve at a time based on the priorities you establish.

The main components to a valve exercise program are:

1. Find and document the valve's location. Note the precise location using global positioning system (GPS) equipment, by traditional surveying, or by measurement based on two or more objects that will be there for a long time. Take a digital picture showing the valve and surrounding area. The point is: don't lose the valve once you have found it.
2. Operate the valve. Exercising the valve is operating the valve at least one full cycle until the valve operates freely with little resistance. This may take several full cycles. (A more detailed discussion on the actual exercising is found below.)
3. Keep and maintain detailed records for each valve. This includes mapping locations on as-built drawings or road maps and maintaining both electronic and hard copies. (Record keeping is discussed in more detail below.)
4. Schedule and perform needed repairs. Often, valve boxes are out of alignment, so much so that a key (a steel handle used for manual turning that come in multiple lengths) cannot get on the valve. Valves are sometimes broken during the exercising program because they have not previously been used. Fixing the broken valves in a timely manner is very important.
5. Repeat these steps on a routine basis. Experts recommend exercising a system's valves annually if possible, or at least once every two years. Some valves will need to have a different schedule than others based on their location or unusual operating conditions. It's usually a good idea to perform the exercising program during moderate weather conditions.

As mentioned at the beginning, the location of many valves is a mystery. Use a metal detector to locate valves in the distribution system.



A worker cleans out the valve box with a utility vacuum cleaner. Removing accumulated sediment and dirt from the gate valve curb box must be done before exercising valves.

When you find a lost valve, note it on system records and mark the location with blue paint so it is easier to spot. If the valve is in a field, a five-foot blue flag or fence post painted blue will work.



For more information about valves, see the Tech Brief titled "Valves" on the National Environmental Services Center Web site at www.nesc.wvu.edu.

Essential Tools

Most water systems should already have the tools needed to do an exercising program. If not, you will need to budget to buy, lease, or rent them. The following is a list of useful tools for valve exercising:

- A utility vacuum cleaner for cleaning accumulated sediment from the gate valve box. Some models are mounted on a trailer or can be installed in the back of a pick-up truck.
- Valve keys or valve box keys for all sizes in your distribution system and extension kits if needed.

- Valve exerciser tool. There are portable, truck-mounted, or trailer-mounted exercising tools. A combination of one portable and either a truck-mounted or trailer-mounted model is desirable. These tools can be powered by electric, hydraulic, or pneumatic means. Keep in mind that for the portable valve exerciser, you have to provide the power supply (i.e., a generator for an electric tool, a hydraulic pump for hydraulic, or an air compressor for the pneumatic).
- A good metal detector to find buried valves.
- Shovels, 20- or 25-foot tape measures, and a 100-foot real tape measure, blue paint to mark the valve box lid when finished, oversized screw driver to aid in removing the lid, flashlight, system maps, street maps, journal (record) book with waterproof pen or pencil, and a digital camera to have a visual record of location.

Don't forget about safety. A flag crew may be needed to direct traffic in some locations.

Exercising Valves

The following are important details when turning the valve. These details should be used with any operation or exercising of a valve:

- Don't force the valve.
- Don't be in a big hurry.
- Use the lowest torque (turning force or rational force) setting possible.
- Avoid using a cheater bar (a handle extension that allows for greater torque). A cheater bar should only be used in emergencies.
- Do not close the valve on the first cycle.
- If and when the valve is nice and free, turn it slowly to avoid water hammer. If you open or close a valve too fast the line could rupture.
- Listen closely. Sometimes you can hear the flow change when operating a valve. This will help determine if the valve is moving.
- Because debris can be stirred up during valve exercising, notify the public before starting the process. This will keep the dirty water complaint calls down.
- Consider doing your flushing program at the same time as your exercising program.
- Always count your turns down and up. They should match.

The American Water Works Association (AWWA) provides these guidelines about how to close a valve properly:

1. Begin with a steady amount of torque in the direction necessary to close the valve, moving through five to 10 rotations.
2. Reverse for two or three rotations.
3. Reverse again and rotate five to 10 more turns in the closing direction.
4. Repeat this procedure until full closure is attained.
5. Once the valve is fully closed, it should be opened a few turns so that high-velocity water flowing under the gates can move the remainder of the sediment downstream with more force and clear the bottom part of the valve body for seating.
6. Fully close the valve again.

"The reason for this cautious approach is that debris and sediment often build up on the gates, stem, and slides," the AWWA's guidance notes. "If this material is compacted while the valve is being closed, the torque required to close the valve continues to build as the material is loaded. If the procedure described above is used, the stem and other parts are 'scrubbed' by the series of back-and-forth motions, and water in the system can flush the debris that has broken loose away from the stem gate and slides or guides." It is advisable to open a nearby fire hydrant to flush the debris that is being cleaned from the gate valves.

Remember that valve manufacturers have detailed operation and maintenance procedures for each of the various types of valves. Some valves have a seating where a resilient coating meets stainless steel. Other valves have actuators isolated from the water flow, meaning that some of the mechanical parts are not subject to as much corrosion and, therefore, may need less exercise. When in doubt, follow the manufacturers' guidelines.

Not as Easy as it Looks

If valves haven't been used in some time (or ever), you will encounter difficulties during the exercise program. The most common problem will be locating some of the valves and if these valves have been lost for a long time, they will need attention.

Another common problem is when the valve is already broken from previous attempts to operate it or the valve stem or operating nut breaks before any movement of the gate. These broken

valves need to be repaired as soon as possible. If you see water gushing as you begin turning the key, the bonnet bolts have most likely broken. Look on the bright side, though: it's better to uncover these problems now than in the middle of the night when the valve is needed.

Some valves seem to be working fine until you get near the closed position and then the gate breaks at or near the closed position. This is most likely caused by tuberculation (build-up) in the gate valve. The worst tuberculation usually occurs at the bottom of the gate valve.

When exercising a valve, resist the urge to "crank it" hard. Dennis Blakely, an account executive with E.H. Wachs Company and an expert on valves, says, "I have seen valves that turn fairly easily all the way down to the near-closed position and then require 10 times more torque to get them to open back up. This is caused by using too much torque the first time you get into the near-closed position. Control of the torque is critical in this situation."

Once you've located valves in the system, keep good records about them. Document as much information as possible, including valve size and type, function, manufacturer, type of access, normal position (open or closed), whether the valve opens right or left, date installed and maintained, and the number of turns required to open or close the valve completely. Master records should be maintained in a central location with an easily printed copy that can be taken out in the field.

Increasingly, systems are using GPS to record the location of valves. GPS can be very useful in area where a hurricane might deposit several feet of sand over a neighborhood.

If your water system has access to a survey crew, map the valves with bearing and distance using a transit. Another method is to use existing as-built drawing that your system may have to denote location.

The reality, however, is that many small water distribution systems don't have the budget for GPS or surveying and no as-built drawings exist. In this situation, use a detailed road map and a tape measure taking at least two measurements from existing objects such as telephone poles, the corner of sidewalks, or buildings to the valve (more than two measurements are better in case one of the objects

disappears over time). Write the measurements on the detailed road map for future reference.

One Valve at a Time

Just getting started can be the biggest hurdle. Water systems will look at the entire system and number of valves with an overwhelming sense that this is an impossible task to accomplish. "In reality, a modest beginning can achieve immediate positive results," Blakely says. "With technological advancements in tooling and proper training, a well-conceived valve exercise program will have a high percentage of positive results. With good planning and execution, a valve exercise program will realize a very low percentage of negative results."

"These facts seem to contradict the general opinion throughout the water utility industry that an exercise program will cause more work and aggravation than it is worth," he continues. "This is simply not the case. The majority of negative results are due to a lack of a valve exercise program in the past. Once problems are identified, repairs can be budgeted and scheduled."

References

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