PIPE REQUIREMENTS FOR ULTRASONIC METERS

Richard Winters | Circuit Rider

I was recently at a water system and the topic of what is the best piping set-up for an ultrasonic water metering installation that would give the best results. Not having the exact answer, I decided to do a little research and see what I could find on the topic. The following information was taken from this website: https://soundwatertech.blog/2017/04/13/straight-pipe-requirements-for-flowmeters/#:~:text=Well%2C%20first%20start%20with%20the%20manufacture%E2%80%99s%20typical%20minimum.,diameter%29.%20%C2%A0In%20most%20cases%20this%20should%20be%20sufficient.

Nearly all types and makes of flowmeters require some length of straight pipe upstream and downstream of the flowmeter itself. Why? Because the flowmeter does not necessarily sense all parts of the fluid inside the pipe. For example, insertion flowmeters only detect the fluid immediately surrounding the probe head, i.e., they do not sense the fluid passing near the pipe wall (away from the probe head). In this case, if the fluid velocity was higher near the pipe wall and lower near the probe head, then the flowmeter would measure lower than the average flow rate, since it does not know about the fluid near the pipe wall. Figure 1 below illustrates a few examples of the fluid flow immediately after typical piping situations: bends, contractions, expansions, and tees. Note that the fluid velocity may become irregular. All types of flowmeters are subject to flow profile (i.e., the shape of the flow as it passes by the flowmeter), although some types of meters are affected more than others. The degree that any flowmeter is affected by the flow profile has a LOT to do with how much of the fluid it "sees" (or senses).

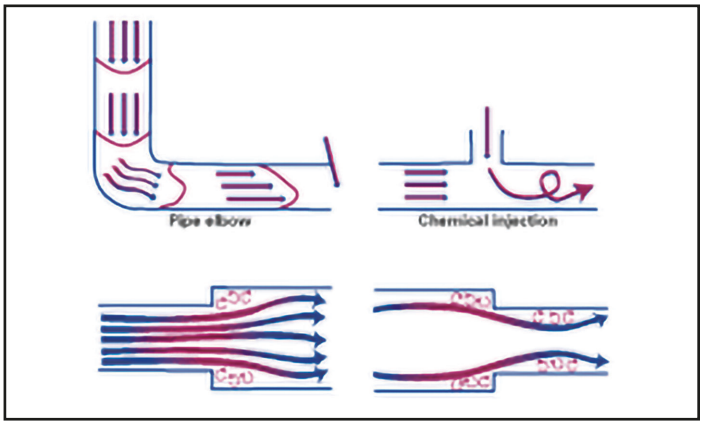

Figure 1
This figure illustrates various types of irregular flow profiles. Not ideal for metering flow.

Flowmeter measurements are more accurate when the fluid flow profile is symmetric and steady. That is, the flow profile is regularly distributed throughout the pipe, and does not change with time. Figure 2 illustrates a good flow profile for any flowmeter, note that is symmetric. The process of changing the flow from irregular to regular is called "conditioning". For example, to change the flow profile from that shown in figure 1 to that shown in figure 2. There are several ways to condition flow, the most basic method is simply to add a length of straight pipe ahead of the flowmeter, so the fluid has time stabilize and become symmetric.

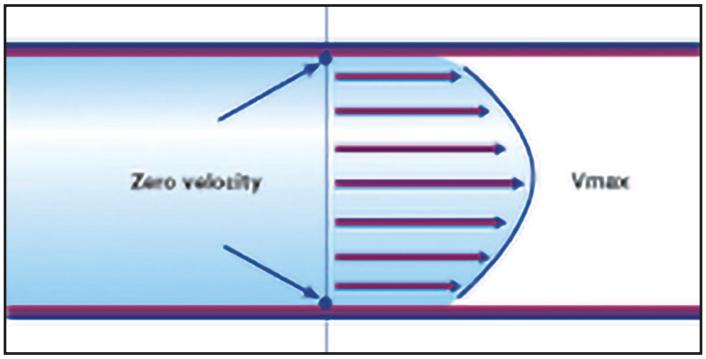

Figure 2
This figure illustrates a typical symmetrical flow profile. Good for metering flow.

Each piping system is unique, and some installations may require straighter pipe that others. Typically, flowmeter manufacturers specify a minimum of 10 to 15 diameters of straight pipe. This means that for a 4" diameter pipe, you would need 10 x 4 = 40"of straight pipe, or for a 2" pipe you would need 10 x 2 = 20" of straight pipe. However, for more severe flow distortions, you may require more.

How much straight pipe do you need? Well, first start with the manufacture's typical minimum. For example, at Sound Water, we specify a minimum of 15 diameters for the Orcas portable ultrasonic flowmeter (i.e., 30" of straight pipe for a 2" pipe diameter). In most cases this should be sufficient. However, to do better, you may evaluate the flow profile yourself using your flowmeter. To do this, simply mount the flowmeter on each side of the pipe, top, bottom, and both sides, and taking a measurement at each location. Compare the measurements collected, and if the flow profile is symmetric the measurements should all be about the same. If the flow profile is irregular, then you may see >>>

differences in the measurements taken at each location around the pipe. With the Orcas flowmeter, this is very easy, since it only take seconds to mount it on any pipe, and it installs on the outside of the pipe (i.e., the meter senses through the pipe wall – no need to cut pipe!).

In some cases, there is just not enough pipe to accommodate the minimum straight pipe requirement. In this case, you should use the 2/3 rule. Install the flowmeter with 2/3 of the pipe upstream of the meter and 1/3 of the pipe downstream of the meter. Again, it is useful to evaluate the symmetry of the flow profile by taking measurements around the pipe as described above.

Finally, if you are as fanatic about flow metering as we are, then install a flow conditioner. This is hardware installed upstream of the straight pipe that helps to forcefully condition the flow profile. There are a handful of designs and manufacturers out there to accommodate most needs. This is a great way to assure you have a good measurement.

If you are planning on installing an ultrasonic flow meter in your water system, I hope you will find the above information helpful. This installation is going to be installed on a very small water system that is having trouble finding a small leak in their distribution system (A system that is newly constructed with all plastic piping). By installing this type of meter on the outgoing pipe just after their storage tank, they can then start at the end of their distribution system and isolate their main valves until they see the meter slow down in gpm's (gallons per minute) equal to the predicted gpm being lost. Please keep in mind that there are many manufacturers of this type of meter and that I simply used the first one I came to, to provide this information. Until next time please stay safe (COVID-19) and everything else that might harm you. 💧💧💧