Managing Water Loss with Pressure Reducing Valves

By: Brad Clark*

On a global basis, it is estimated that 33 billion cubic meters of treated water is lost at an estimated cost of USD 15 billion US per year. Water loss, also known as non-revenue water (NRW), is a significant problem worldwide in potable water distribution systems. System losses vary by utility; however, water losses ranging from 15% to 70% are common. When a utility undertakes a major water loss project, multiple control zones with a single source of water (if possible) are required. These zones are referred to as DMAs or District Metered Areas. It is common for a mid to large sized utility to establish hundreds of DMAs. Assuming residential, commercial and industrial users are being metered, you now have measured flow into the DMA as well as flow to users.

There is a direct correlation to pressure and leakage; if you reduce pressure by 1% you will reduce leakage by approximately 1.15% (subject to variation). The goal then is to develop multiple smaller DMAs within a utility and give clients just enough pressure to serve their needs while eliminating over pressures. It is common knowledge that a good pressure management approach is one of many solutions to reduce water loss and it is typically the most economical approach with immediate results.

Each DMA requires a meter as well as a pilot-operated control valve. These valves are built to different standards worldwide and vary from manufacturer to manufacturer. Different quality materials may be used by different manufacturers. There are also many options that can be added to increase the life of these valves or that can make maintenance easier. Here are your options when it comes to pilot operated control valves for reducing pressure and leakage.

Standard pressure reducing valve (PRV)

A standard pressure reducing valve is familiar to most users worldwide. For a utility that is undertaking pressure management and establishing DMAs, this is often an excellent selection. This valve has typically one pilot and one pressure setting. You manually set the pilot to the one pressure you desire downstream and that is the pressure you get. Downstream pressure setting is maintained as a constant regardless of varying upstream pressures or flow rates. This style of valve needs a differential pressure of 10 psi or .6 bar between the inlet and outlet of the valve to function effectively. To change pressure, the operator must adjust the valve manually by changing the pressure setting on the pilot. This style of valve works very well with medium to high system pressures. If available pressure differential drops below 10 psi (.6 bar), pressure reducing valves can not open fully and as the available pressure drop is further reduced, flow approaches zero.

Low pressure PRVs

If very low pressures are encountered during peak demand periods, standard PRVs can not supply the required flow. If inlet pressures drop below 10 psi (.6 bar), the differential pressure across the valve is not enough to maintain the valve in the open position. The valve capacity is reduced and downstream customers may not have enough water. This issue can be overcome by using two pilots. The first pilot is a standard PRV pilot that is used to control or reduce pressure at non-peak usage periods. The second pilot is a modified altitude pilot that allows the main valve bonnet to vent to atmosphere at a predetermined low pressure (usually just below the downstream set-point). When the inlet pressure drops below the low pressure set point, the main valve opens fully, minimizing pressure loss through the fully open valve at peak demand periods. The valve can open fully even with pressures as low as 2 psi (.13 bar).

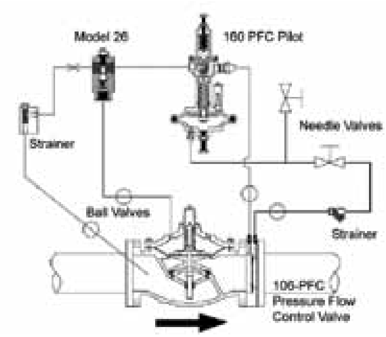
A standard PRV typically has the pilot set for the lowest pressure required at peak demand to make sure that all users have enough pressure to satisfy their needs. Remember that the outlet pressure setting remains constant, regardless of variances in inlet pressure or flow rate. At non-peak usage periods (night), there is less demand on the system so pressure loss though the distribution and service mains is much less, resulting in higher downstream pressures especially in areas remote from the PRV. At non-peak times, the increased pressure has two negative outcomes:

1) Leakage rates increase
2) Pipe bursts tend to correspond to higher pressure periods

The above scenario can be overcome in part by using two standard PRV pilots on the main valve. One PRV pilot is set for the high demand pressure (day time) while the other pilot is set for low demand pressure (night time). A solenoid valve is supplied and a basic timing controller decides which of the two pilots is utilized based on the time. Depending on availability of power, a standard solenoid with a locally sourced timing device may be used or, alternately, if no power is available, a battery operated timer (submersible) combined with a latching solenoid valve using minimal power may be utilized. The above options can be very economical with excellent results. One consideration is the fire department minimum pressure requirements.

Pressure reducing valves—Self adjusting based on flow (Pressure/Flow Control)

Combination pressure flow control valves can be a very interesting option. This style of valve senses flow through pressure differential across either a correctly sized orifice plate or partially open gate valve down stream of the PRV. The standard PRV pilot has a large secondary diaphragm operator that adjusts the pilot setpoint based on flow. The PRV pilot is set for minimum (night) pressure. The secondary operator then increases the setpoint as the flow increases. Minimum setpoint and pressure increase are determined to assure adequate pressure in all parts of the DMA at peak demand. Limitation of this style of valve is that it must be a single source to a DMA. Multiple valves feeding a DMA will not function correctly.



PRVs incorporating third party control—time switched or flow modulation

When utilizing this type of control, a standard PRV, complete with main valve and pilot, is utilized. A third party manufacturer of controllers and interface units will adapt its equipment to interface with the PRV manufacturer's pilot. Usually a Bias chamber will be mounted under the pilot or an actuation device will be mounted on top of the pilot depending on the controller manufacturer.

Flow modulation will react to flow variations in the system and adjust the pressure accordingly. If flow modulation is not required, then time based control can be utilized with this equipment as an option.

PRV Pre-Packaged Systems

Utilities throughout the U.S. and Canada are utilizing pre-packaged systems on pressure reduction stations. These pre-packaged stations make sense for use in DMAs because they are built in a clean environment, pre-tested, quicker to install on site and can be custom designed and often are more economical. ■

Source:
**Brad Clarke, VP of Sales and Marketing for Singer Valve Inc.*
Web: *www.singervalve.com*

يعتبر هدر المياه في شبكات توزيع المياه الصالحة للشرب مشكلة كبيرة في جميع أنحاء العالم. من المتوقع أن يتم فقدان ٣٣ مليار متر مكعب من المياه المعالجة بتكلفة تقدر بـ ١٥ مليار دولار سنوياً. تختلف نسبة الهدر في أنظمة المياه، ولكن بشكلٍ عام، تتراوح نسب هدر المياه الأكثر شيوعاً بين ١٥٪ و ٧٠٪. عندما تتعهد شركة ما بإنجاز مشروع كبير لهدر المياه، عليها أن تعي العلاقة المباشرة بين الضغط وتسريب المياه. عندما ينخفض الضغط بنسبة ١٪، ينخفض التسريب بنسبة ١٫١٥٪. من المعروف أن الإدارة الجيدة للضغط هي إحدى الحلول المقترحة للحدّ من هدر المياه، وهي من أكثر الطرق الإقتصادية بنتائج فورية. لذلك يأتي هذا المقال ليعرض بعض الخيارات لصمّامات التحكّم التي تحدّ من الضغط والتسريبات.

McElroy Introduces Guided Side-Bend Tester

McElroy, the leader in pipe fusion equipment and accessories, recently introduced the Guided Side-Bend Tester. The quality assurance device performs a qualitative test for ductility in a fusion joint. The Guided Side-Bend Tester is a quick, safe replacement for "bend back" tests that have been performed in the field for many years. With the new equipment, an operator can perform a bend-back test on polyethylene pipes with 1 to 7 inches of wall thickness. This testing method places the entire wall thickness into tension and gives assurance of the ductility of joints. The test unit is compact and requires just a few common tools to conduct the process. "Our quality assurance tools are designed with the operator in mind," said *Chip McElroy*, president of McElroy. "This quick and simple test, when paired with our DataLogger® recording device can ensure others that fusion procedures were followed, that destructive tests were used and that results met expectations."

The tester works by using a planer to cut a test coupon that is then put into a hydraulically powered device. The testing device bends the coupon in a controlled manner to strain the fusion joint past the material's yield point. If no breaks or gaps are visible in the joint, the coupon and fusion joint has passed the test. No external power is required for the device, and the tester equipment weighs less than 30 pounds. Operators will need a saw, planer and calipers to perform testing with McElroy's Guided Side-Bend Tester. The tester can be used alongside McElroy's In Field™ Tensile Tester to complete a full range of testing tools that will destructively test key elements of a fusion joint. Besides, McElroy's Guided Side-Bend Tester performs a qualitative test of a fusion joint by destructively testing a coupon. ■

Guided side-bend tester package