Right flows can lift the lows

Paradoxically, one of the traditional solutions for water losses through leakage is to increase production – but this is uneconomic, unecological, and can lead to pipe bursts. Peter Oppinger says the right solution lies in correct flow control.

PIPE AND valve leaks in urban water systems – mainly in developing countries – are the cause of water losses of up to 50%. This is half of the quantity produced by the water plant.

To overcome this problem, the water sector often increases production rather than driving initiatives to reduce water losses. Cutting water losses is the most economic – and ecological – solution.

But, when production is increased, the structure of the pipeline system – originally designed for much smaller output volumes – remains the same.

Pipe bursts

In particular, the valves that regulate flows and pressures cannot do their job properly. If they cannot be controlled precisely, this will lead to pipe bursts. It can even lead, ultimately, to the collapse of an entire distribution system.

Regulating and control valves can control flows and pressures, or simply open and close water distribution pipelines.

VAG-Armaturen makes solutions that reduce water loss. A control device – a plunger valve – and a pressure sensor, together with a flow meter, are installed at the supply area's feed point. A programmable logic controller (PLC) records, processes and archives the measured sensor data.

Depending on the supply system's topography and consumption, the plunger valve is moved into the position that optimally reduces supply pressure. Reducing the pressure cuts down on the amount of water loss. Also, lowering the supply pressure reduces the risk of new leaks.

The feeding volume and supply pressure are monitored, and available for review. Secure cellular technology is used to transfer the data to a PC. A software programme enables the utility to follow the valve's operation online. Failures are sent directly to the service team in an SMS alert. Service personnel are only notified when really necessary.

The system solution from VAG consists of several components (see figure 1). At the heart of the system is a VAG plunger valve. Based on the type of local power supply in the utility's network system, the control valve is powered by a DC, AC, or three-phase actuator. A flow meter records the volume of water that is supplied to the distribution area. The pressure sensor behind the bypass is used as an actual value for the pressure reduction function of the PLC. Status information about the volume taken, the measured pressure, and the actuator converge here.

There is a certain amount of civil works required. VAG helps utilities pick the right spot for the installation. The VAG package consists of a plunger valve, pressure sensor, flow meter, a programmed controller and, optionally, a cellular modem to transfer data to the central control station. The system is put into operation by one of VAG's engineers. VAG can also run a training course for engineers at the utility. The VAG RIKO plunger valve uses these modes to reduce water pressure:

- Time-based modulation
- Flow or demand-based modulation
- Remote node-based modulation

Time-based modulation is achieved by using a controller with an internal timer to change the set point of the fixed-outlet control. Control is in time bands, in accordance with demand profiles. It is effective for areas with stable demand profiles and is usually used where proactive pressure management is desired.

The step before this is fixed-outlet modulation, which is the most basic control. It is achieved by modulating the valve to provide a steady outlet pressure. A flow meter in the main supply pipeline recognises the demand for water in the network.

Changing conditions

This value is sent to a computer, where an evaluated curve, specifically for the network, is stored. The curve shows the minimum pressure necessary to maintain the related flow rate. This method has, in the past, proven to be an effective type of control for areas with changing conditions, head loss, fire-flow requirements, and the need for proactive control. As demand is reduced at night, pressures are reduced. When demands peak, higher pressures can be applied. The effect is an efficient control of pressure, water losses.

Critical point

With remote node-based modulation, the pressure will be measured directly in the network at a critical point. The signal is sent via a wireless connection to the control valve. This type of control is probably the most proactive, and is effected by connecting a remote pressure sensor to the valve controller, by means of radio or GSM. The remote sensor is usually placed at a critical point, and the controller set to change the pressure at the valve.

This is to always maintain the desired pressure in the network system. As with the flow-based modulation, this mode of operation also smooths system pressure at the weaker extremities.

The VAG RIKO plunger valve regulates pressure in a pipe system to achieve the correct flow rate and network pressure.

The plunger valve has these design features:

- The cross-section of the flow is annular in each position of the valve
- The axially movable closing device is shaped like a piston or a plunger

The new VAG RIKO plunger valve comes in nominal widths from DN 150 up to DN 1,600, and a range of pressure numbers from ten to 40.

The single-piece body is made of ductile cast iron. The inner body is connected to the outer body by cast ribs. On the upstream side, the inner body has a spherical shape.

The shape of the annular space results in a continuous narrowing towards the seat on the downstream side. Depending on the hydraulic conditions, there are different outlet parts available.

Stainless steel

The cross-section is reduced in its flow – which is symmetrical to the axis – until the fully closed position of the piston is reached. The piston or plunger is normally made of stainless steel. It is operated by an internal piston drive made of ductile cast iron or stainless steel. The VAG plunger piston drive is connected by a stainless-steel shaft to a gear box assembled to a connecting flange on the outside of the body.

Unlike butterfly or gate valves, which assume shutoff functions in pipeline systems, plunger valves can regulate operations. ■

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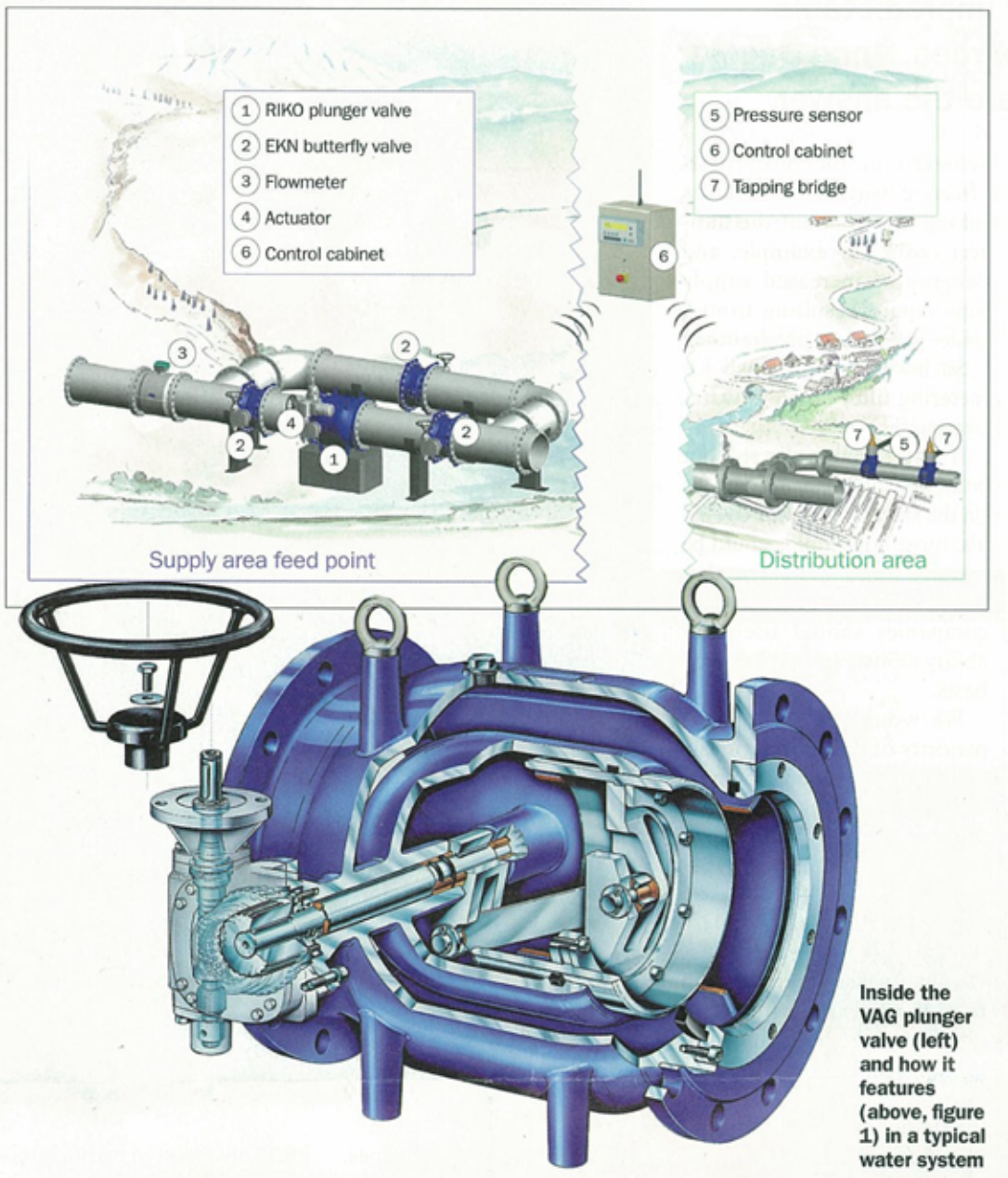

Inside the VAG plunger valve (left) and how it features (above, figure 1) in a typical water system

Project takes on water loss, pipe breaks in São Paulo

Water consumption in São Paulo, Brazil, is on the rise. Today, for local water supplier Companhia de Saneamento Básico do Estado de São Paulo (SABESP), it is a challenge to meet the water demands of the 17M people in São Paulo. SABESP has the task of ensuring a constant supply of potable water in sufficient quantities.

Despite the service provided by the company, it is possible to experience periods of supply problems, caused by lack of resources during dry periods. One reason for the lack of water supply is the high volume of leakage that takes place during operation. This happens at critical points like mains and fittings. If pressure is managed effectively, water loss is reduced.

VAG's challenge was to combat loss. It was also to apply water pressure to the pipeline system when required – and reduce pressure when demand was at the lowest.

The project deployed the VAG RIKO plunger valve through the system, operating on a remote node modulation basis.

Supported by the German government – and in cooperation the Germany Society of Development and SABESP – VAG started a project for sustainable water and natural resources management in São Paulo in 2004.

VAG and SABESP installed a pilot site in the district of Santo Amaro – with a population of about 30,000 people and five miles of distribution pipes. The scheme consisted of a sophisticated water-loss-reduction system. This comprised of pressure-regulating valves, control panels, telemetry installations and supporting software. The site demonstrated that modulated pressure management significantly reduces both volume of water loss and frequency of pipe breaks.

For the Santo Amaro district, this meant a reduction of up to 50% of pipe breaks and 30% cut in loss of volume. This is enough to supply an additional 8,000 people with potable water.