Keeping Pace
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Manual, quick-coupler systems were the early choice for parks, fairways and athletic fields. To irrigate these large areas with the least number of heads, large, high-pressure impact sprinklers were necessary. Unfortunately, the uniformity of the spray pattern from these heads was comparatively poor. Irrigating with these systems was also labor intensive since each head must be snapped into place to start irrigating and removed to stop.

Early automatic controllers, developed to reduce labor costs, were very limited in scheduling flexibility. With so few stations available on a clock controller, "there was a tendency to put as many heads on each lateral as possible," remarks Toro's Don Fisher. As a result, shaded areas would often receive the same amount of water as sunny areas. When the sunny areas were dry, the shaded areas were still wet.

Control over water pressure was also poor. Systems using city water can experience great variations in pressure. As the pressure changes the distribution of water from the sprinkler changes. "Water changes its pattern depending upon the pressure," explains Bob Cloud of Associated Irrigation Consultants in Los Angeles, CA. "A manufacturer usually specifies that a sprinkler head should work between a range of pressures. It's not uncommon to have 25 pounds' difference in operating pressure when using city water. When the pressure exceeds the manufacturer's recommendation, the head will not come close to its desired diamater because the water will atomize and mist."

As the pressure changes, the distribution of water from the sprinkler head changes.

Many golf courses and parks use wells as a source of irrigation water and pumps to generate system pressure. The higher the system pressure the harder these pumps have to work. "Twenty-five years ago," says Richard Choate of Weather-matic, "pumping systems had to use a lot of energy to deliver the pressure needed to operate the sprinklers common in those days. Pumps had to produce enough pressure to overcome friction losses in the pipes and valves in addition to the high pressures required by the heads."

"There is a definite trend toward lower pressure systems," observes Larry Keesen, president of Larry Keeson Irrigation Design & Consulting. "By using smaller heads and reducing the spacing we can get better coverage at lower pressure. Basically, what you get is a larger droplet that is less prone to wind and misting. Better distribution results in better coverage."

Lower pressure systems save money since energy costs for pumping are directly proportional to the pressure. "If you lower the pressure 20 percent, you'll save 20 percent on your electric bill," says Fisher. "That can be thousands of dollars a year."

There is a trade off, it takes a low pressure head longer than a higher pressure head to apply a given amount of water. "Sports turf managers only have a certain amount of time to irrigate," says Brandon

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Troubleshooting Irrigation Valves

Valves Whether a valve is manually controlled, remote-controlled or automatic, it performs one of the following functions: releasing water into the distribution lines or into a sprinkler head; retaining water at a certain point in the distribution system to maintain a desired pressure; or draining lines.

The simplest irrigation system is manually controlled. It generally uses either angle-type or globe-type valves that are turned by hand to release water to sprinklers nearby.

The majority of valves in modern, automatic irrigation systems are known as remote control valves. These valves open and close according to signals they receive from a field switching terminal or satellite controller. These signals are either hydraulic pulses directly to the valve or electric currents received by a solenoid attached to the valve. Whether the valve is hydraulic or electric, hydraulic pressure is used to open or close it. Most remote control valves are designed to withstand burial, but their placement in a valve box permits easy access for servicing or for manual operation.

Most remote control valves are a globe design. Valve operation is based on a pressure differential between the top and bottom of a diaphragm or piston. Control of the movement of water through specially-designed ports and chambers within the valve allows water pressure to be applied in such a way to open or close the valve assembly. The assembly may be either a diaphragm or piston type. The diaphragm valve is used more often because piston valves have washers and rings that require periodic servicing and replacement.

Automatic valves are either "normally open" or "normally closed," referring to the position the valve assumes if the hydraulic or electric control line is cut or broken. Electric valves are "normally closed" while hydraulic valves can be either type.

It is vital that the water which is used to operate the valves through hydraulic control tubing be absolutely clean. In addition, wherever freezing is possible, all water must be blown out of the hydraulic control tubing with an air compressor. For this reason and others, the trend is away from hydraulic valves toward electric ones. "Hydraulic systems are difficult to maintain and troubleshoot," says Rain Bird's Rod McWhirter.

A valve-in-head design is being used today for larger pop-up sprinkler heads, often where quick-coupler systems are converted to automatic. The valve is located in the base of the sprinkler head housing or below the head in valve-under-head versions. This location allows independent control of each head. However, since each head has its own valve, it uses up one station on the controller making a large number of valve-in-head sprinklers impractical.

"Valve-in-head sprinklers are being misused in some locations," says Truttman. To operate more than one from a single station, turf managers are linking valve-in-heads together with a common wire. "It's really preferable to use a separate valve and standard heads from a maintenance standpoint," he explains.

Since standard electric valves are the most commonly used control valves in the industry today, we will zero in on them first with maintenance tips.

An electric valve can be opened manually by opening the bleed button or bleed screw approximately one turn. A small amount of water normally bleeds out when this is done. Close the bleed valve to return the valve to normal operation.

To shut off an electric valve manually, turn the flow control clockwise one-half turn at a time until hand-tight. It is not necessary to use a wrench. The pressure downstream from the valve can be adjusted by turning the flow control knob.

If an electric valve was recently installed and it is not operating properly, first check its position. Electric valves can't be installed upside down, on their side or pointing down since this will trap air in the bonnet cavity and cause the valve to chatter and probably fail to close. By leveling out the valve it will operate as designed. Also check to see that the direction of flow matches the arrows on the valve.

There is a trend toward electric valves (background) from hydraulic valves (foreground). Photo courtesy of Toro.

If the valve is in the right position and still doesn't open, first check the flow control handle to make sure it is open. If it's open, check the pressure in the main and the voltage from the controller. If these are proper, then the problem could be the solenoid. Attach a 24 VAC coil with a 12 VDC battery to the solenoid. If none of these methods work, the valve may need to be dissassembled.

If the valve fails to close, check to see that the current from the controller is off. If the valve is only partially closed, turn the flow control handle down to assist the closing action. If these don't work, the valve may need to be dissassembled.

To tear down the valve in the field, first turn off the water supply. Manually bleed the valve to remove pressure from the line. Then, remove the screws or nuts and remove the bonnet. Leave the solenoid in place to avoid getting dirt in the solenoid assembly.

You are now looking at the diaphragm assembly. Inspect it for any obstructions between the seat and the seat seal. Check for condition and either replace or reassemble.

Now, check for plugged porting between the bonnet and the solenoid and from the solenoid cavity downstream. Make sure the solenoid plunger moves freely up and down. Check for any damage to the solenoid seat in the bonnet or seal in the solenoid plunger.

Clean all parts thoroughly. Reinstall the diaphragm. If applicable, tuck the diaphragm bead in carefully before replacing the spring and bonnet. Don't forget the body "O" ring. Make sure the bonnet is on straight. Start all screws or nuts before tightening. Tighten one nut and then the nut on the opposite side of the bonnet until all are secure. Now install the solenoid with the "O" ring. Finally, check all electrical connections to the solenoid.

Close the bleed valve and open the water supply. Test the valve again for operation. It is wise to have spare valves in case field repairs don't locate the problem. You can also see the advantage of installing valves in valve boxes.

When hydraulic valves fail to close there is some type of leak in the hydraulic system, either a loose bleed screw, a leak in a control line or loose fittings. If they won't open, the cause may be crimped or plugged control lines. Like with an electric valve, debris can get caught between the diaphragm seat and valve seat. The condition of the diaphragm and the stem should also be checked.