Technological Considerations For Automatic Irrigation

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THIS DISCUSSION will cover three important aspects of irrigation technology — the differences in method of sprinkler head rotation, the methods of controlling valves, and the controllers. These are the subjects that must be given serious thought when taking steps toward automating an irrigation system, but they have not been well compared in recent literature.

Sprinkler heads have really not changed dramatically in a long time. Pop-up sprinklers have been available since the 1920s, and gear-driven heads have been available since the 1930s. Golf courses installing an automatic system or converting a manual system to automatic need to decide whether to use impact (impulse) heads or gear-driven heads. Both types are available in many diameters of coverage with similar precipitation rates.

Those who prefer the impact-type head point out that these heads are easier to work on, have few moving parts, and, when they break down, they are relatively inexpensive to repair, compared to gear-driven heads. They also note that these heads have a reputation for handling dirty water better than the gear-driven heads, and that less pressure is needed to operate impact-type heads. It should be noted here that if dirty water is used for irrigation, any head or valve with a screen in the bottom will need to be removed periodically and cleaned, otherwise a pressure reduction will change the distribution pattern.

Those who prefer gear-driven heads cite the smooth, quiet, uniform rotation of these heads. The uniform rotation permits them to time syringe cycles accurately by knowing that if one head makes a full turn in two minutes, then all heads of that model will make a full turn in approximately the same time. In comparison, the spring tension of impact heads may need constant adjustment to compensate for changes in temperature and wear in order to obtain uniform timing of full turns. Head rotation of impact heads can become excessively slow and the distribution pattern can be poor if routine preventive maintenance is not properly carried out.

Some feel a big advantage for selecting the gear-driven head is that it is also available in two-speed models which can be very useful in watering the banks around greens and on the backs of tees where sprinklers don't overlap. Although two-speed heads are used in other situations, their use in the two locations cited gives them a distinct advantage. It should be noted that two-speed and part-circle heads have been known to go out of adjustment, so there is a need to monitor the coverage pattern. Those who use gear-driven heads do not feel that dirty water is any more a problem than it is with impact heads; the enclosed gears seem not to be affected by water quality.

Regardless of what type head is chosen, the control valve determines whether it comes on or goes off properly. The control valve is usually activated by an electrical current change or by a change in water pressure. Also available is a system to activate valves by dramatically lowering and raising the pressure at the pump station. Most valves, however, need electrical wire or hydraulic tubing to convey the signal to the valve. The trend appears to be electric control.

ONE ADVANTAGE of hydraulic control is great freedom of the system from lightning damage. In areas such as Florida, where lightning damage is a serious problem, this method of valve control has to be given serious consideration. Cost comparisons give an edge to hydraulic at time of installation, but the feeling is that this advantage is quickly lost when maintenance problems arise. Squirrels and gophers, for example, like to chew on hydraulic tubing, clean water is essential for hydraulic controls, and leaks in the tubing are always difficult to find. These potential problems result in increased maintenance costs. It should be noted that when hydraulic tubing breaks, not only is there an immediate need to repair the break, but after the break is repaired, dirt that entered the broken tubing may show up at the valve and cause further problems. The new electrical fault-finders make finding breaks in electrical wiring easier than locating leaks in hydraulic tubing. Hydraulic control of valves cannot be used where the difference in elevation between controllers and valves is more than 32 feet. Anything over this height variance will affect the operation of the valve.

Where freezing is a problem, the hydraulic tubing in the control boxes must be kept warm when temperatures drop below freezing or the normally open valves will be activated and the normally closed valves cannot be used to remove frost automatically. One solution to this problem used in at least one area of the country is to convert hydraulic controls to pneumatic controls. This can be done with minor changes in the system, but this practice is not encouraged by the manufacturer or by one superintendent who converted to such a system. The air must be dry or this system, too, can experience freezing problems.

In a few areas, the electrical code requires that any wiring above 20 volts of alternating current that is placed underground must be shielded. These requirements result in abnormally high costs of installation of electrical control wires, and this tips the cost balance to hydraulic tubing and valves, which then becomes a much cheaper control system. Superintendents who discussed these two methods of control expressed concern for closer quality control in valve manufacture. They believe strongly that

if you have poor valves, the method of valve control is unimportant. Quality control is an extremely important consideration for a product that is placed in the ground where it is difficult to repair.

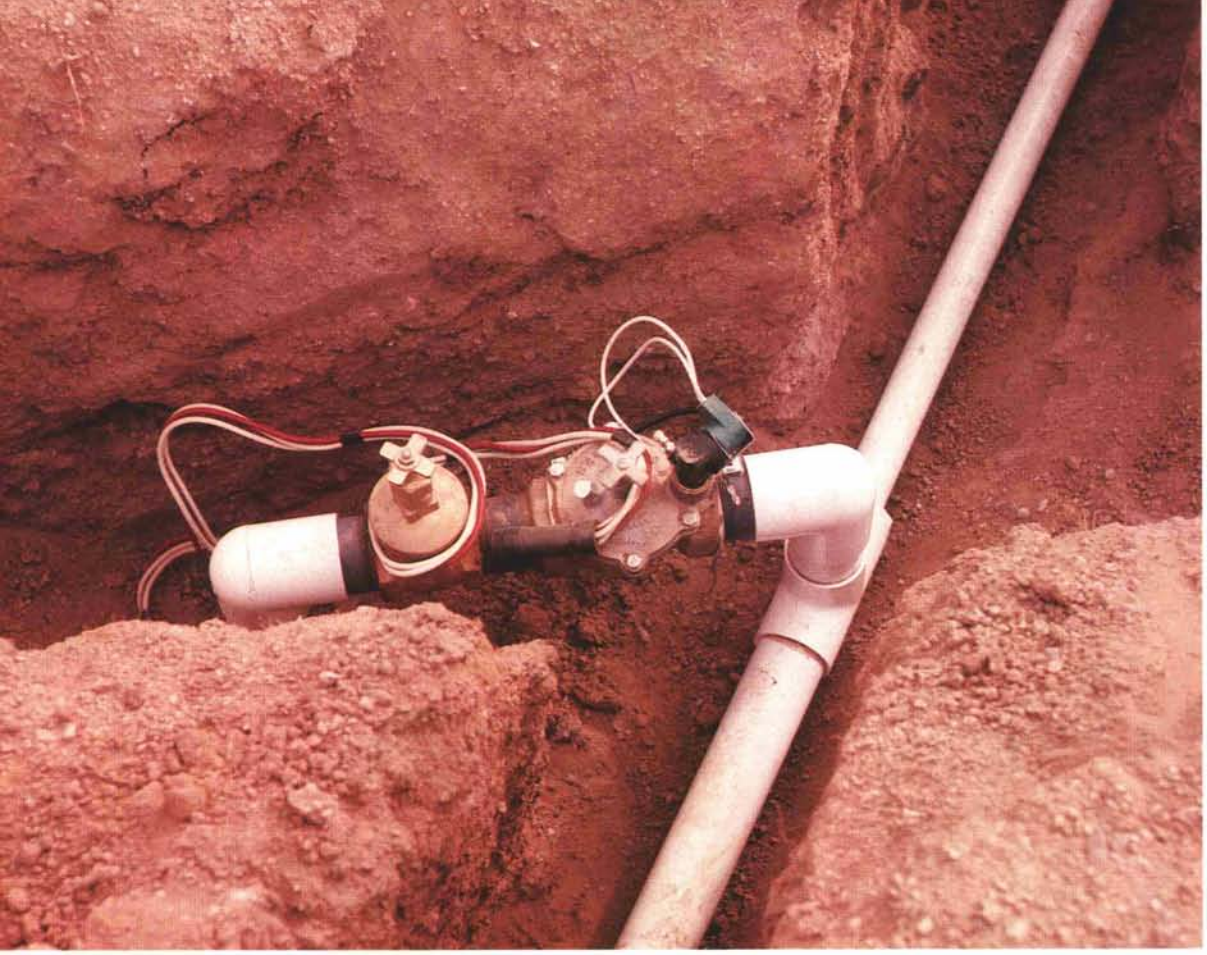
THE NEXT QUESTION posed to the contributors was, "What type controller do you prefer and why?" All the golf course superintendents who contributed seemed to agree that they would prefer the flexibility of sophisticated computer controllers, even though they had not made that choice when installing their system. The reasons were not just a matter of cost, but they were not sure the computer controllers were completely free of problems. They were waiting for the technology to develop further, while those who chose to install it were spending time improving what they had. Reportedly, computerized systems are now taking hold rapidly on the West Coast, the heart of the turf irrigation industry. One assumes that in time this technology will prove itself and be used across the country. It certainly makes possible a flexibility that superintendents previously have only dreamed about.

(Top) Sand separator is used to remove sand from water since automatic irrigation systems need to be run on reasonably clean water.

(Above) Computer controllers should be located in the maintenance building to better protect them from vandalism and lightning damage.

When one considers that golf courses in the Southwest may have up to 2,500 heads that can be valve-controlled individually or by perhaps some 800 separate valves, the advantages that a computer provides certainly cannot be ignored. The problems with computer controllers, other than cost, appear to be their sensitivity to power surges and a difficulty in having repair work done. Surges occur in the power lines and when lightning strikes nearby.

Another disadvantage of this type of equipment is the need to re-program the computer if the electricity is lost for a longer period than the battery will maintain the memory. While computer programming has come a long way, it still is not for everyone. The electromechanical controllers have proven to be very dependable, and most superintendents consider them relatively easy to repair, allowing them to do much of their own repair work. However, when a problem occurs with a computerized operation, one must call in a factory technician or return the



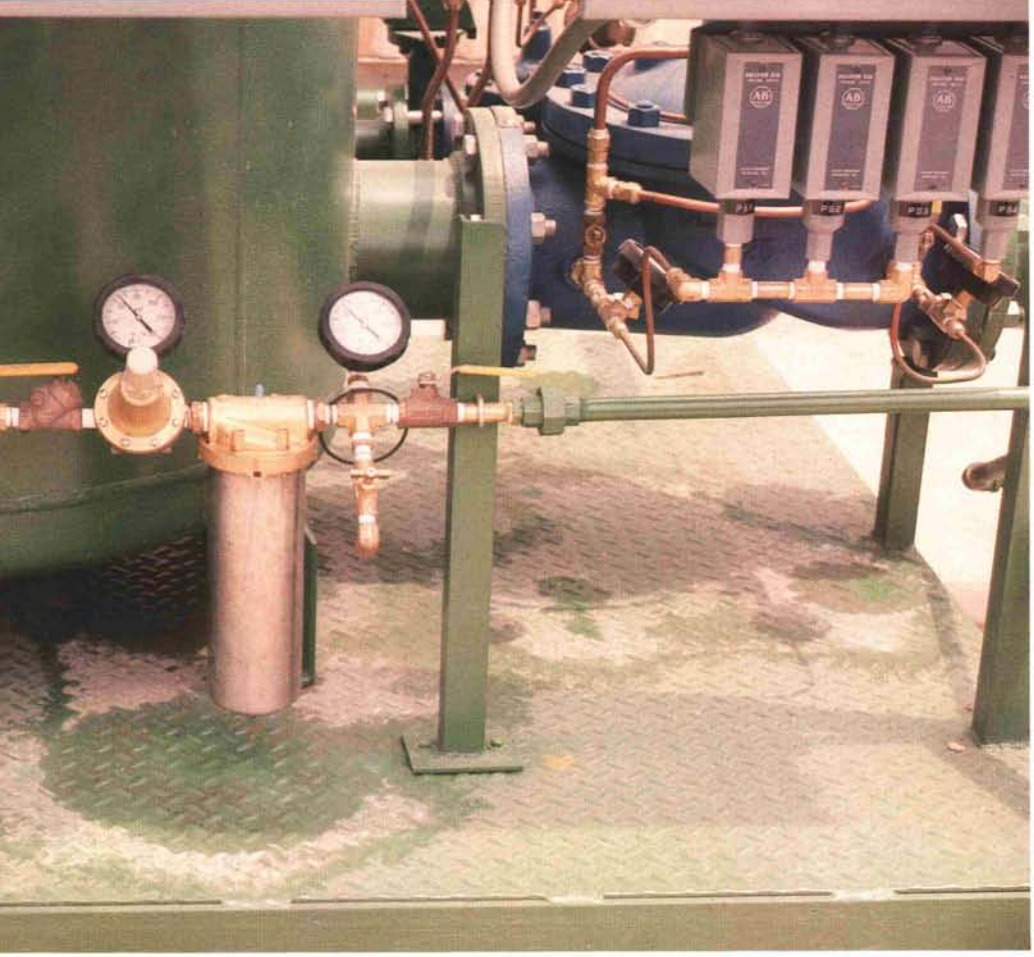
Gate valve and electric valve serving three fairway heads — note slack wire for easier repair of electric valve. Gate valve permits electric valve to be worked on while the system is pressurized.

device to the manufacturer for repair. It is believed that computer controllers will probably come down in price within 10 years. If so, their ability to assist the superintendent may increase. Irrigation computer technology and equipment are presently undergoing rapid development. Having the essentials now for an automatic system, how does one put it together so that it does what you want it to do? The ultimate in control would be a valve for every head and a station on the controller for each valve. The costs are not as severe as might be expected. The smaller valves needed to control individual heads are considerably cheaper than the larger valves needed for multiple head control. However, the cost of wiring or hydraulic tubing increases dramatically, and the controller costs will increase tremendously unless the large computer controllers are used.

Where most of the water the green receives comes from irrigation, individual head control on greens, in my opinion, is preferable because this gives the superintendent the ability to overcome two problems. First, the front of the green does not normally need much water since greens tend to drain to the front and this area is usually overlapped by an approach head. The back of the green is normally not covered by overlapping sprinklers, is often elevated, sloped and exposed to wind, and, therefore, it requires more irrigation time. Secondly, the problem of shifting winds also helps justify the need for individual head control. Because the wind is constantly changing, there will be a need to alter the times of each sprinkler head with seasonal wind changes. It should be noted that even with individual head control on greens, there may still be a need for hand watering if greens are to be maintained uniformly and on the dry side. A teeing area can be watered from the same valve if one sprinkler head is located at the back edge of the tee. If not, the problem of coverage is similar to that which exists on the back of a green in that there is no overlap from other heads.

ON FAIRWAYS the usual tendency with double- and triple-row systems is to place two or three heads diagonally across the fairway on the same valve. On flat terrain courses with uniform soils this creates no problem, but as most golf courses are constructed on rolling terrain, this sometimes creates the problem of one valve controlling a sprinkler located in a low spot and another located on a high spot. When this occurs, the advantages of automatic irrigation quickly disappear because the low areas become overwatered and subsequently need to be drained. Golf courses in the arid Southwest often install as many drain lines as golf courses in the humid East. The cost of the installation and maintenance on a system with a valve per head is expensive. Therefore, compromises are made in the decision-making process even in the arid Southwest, which sometimes results in an automatic fairway irrigation system with less than desirable ability to put the water where it is needed.

In closing, it should be noted that there are many ways to successfully irrigate a golf course. Automatic irrigation, if quality designed and properly installed, places the responsibility of irrigation into the hands of the most highly trained individual on the staff, the golf course superintendent. If designed poorly, and if poor-quality



Filter and line for hydraulic controls. Hydraulic control systems require filtered water.

equipment is used, an automatic irrigation system may present more problems in irrigating a golf course uniformly than a manual system.

This article is partly made possible by the contribution of thoughts on the subject from the following: Golf Course Superintendents Art Snyder, II, Tucson Country Club, Arizona; Rollie Cahalane, Inverness Golf Club, Colorado; Donald Clemans, The Olive-Glenn Country Club, Wyoming; Gary Grigg, Raveneaux Country Club, Texas; and Karl Olson, Fort Douglas Club/Hidden Valley Country Club, Utah. Contributing from industry were the following: Charles Amos, Rain Bird Sprinkler Manufacturing Company; Richard Choate and Mike Morey, Weather-matic Division of Telsco Industries; and Donald Montgomery, Toro Manufacturing Company. Two members of our USGA Green Section Staff, Don Hoos and Charles White, contributed, also. The author accepts full responsibility for the blending of their thoughts.

Maintenance Aids

A TIP FROM

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AFTER TORRENTIAL rains, water used to back up and thoroughly saturate acres of turf on holes bordering our pond. This problem was corrected by constructing the relief swale pictured, to allow the water to circumvent the dam during periods of excessive rain, and direct water away from the 14th green and other adjoining holes. The relief swale, constructed at the time the golf cart path was being installed to bridge the pipes shown, directs the excess water around the bridge and into the stream in the foreground, making these low holes playable and maintainable soon after heavy rains.