ANATOMY OF AN AUTOMATED IRRIGATION SYSTEM

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Every irrigation system starts with a water supply, also known as the point of connection or POC. Most common and most costly is metered potable water. When working with municipality supplied metered potable water a backflow prevention device is required and by ordinance, must be recertified on an annual basis. This is to prevent possible contamination of a public water supply. Alternative supplies include reclaimed water, well water and storage reservoirs. Most alternative supplies will require a filtration system to prevent debris from clogging nozzles or causing valves to malfunction.

Important knowledge about the water supply is dynamic operating pressure and available flow. Dynamic operating pressure is a reading of pounds per square inch measured while the system is in operation. Ideal pressure for most sprinklers is a range of 40-50 p.s.i. If the pressure is too low, the sprinklers won't reach as far as intended and result in uneven coverage. To compensate for the poor coverage, the systems are run for longer periods of time and water is wasted. On the other hand, when the pressure gets to high the water droplets become very fine and are easily blown off the target area. This effect is called misting and causes many thousands of dollars in damages to windows on commercial buildings. Pressure problems can be corrected by using booster pumps to increase pressure or pressure regulating valves to reduce pressure.

Available flow is the quantity of water that can be supplied and is measured as gallons per minute. An irrigation system design should never exceed 75% of the available flow. If the water supply is a well it would be wise to be even more conservative on the design.

The piping system that carries water from the POC to the individual station remote control valves is called the mainline. The size of the pipe diameter is determined during the design phase and must be large enough to carry the amount of water required to operate the sprinklers. The mainline is under pressure 24 hours a day and even a slow leak can waste a lot of water, cause property damage and create liabilities. If the system is metered it is pretty simple to check for leaks by observing the meter for movement when the system is not in operation. Other signs of leaking mainlines are running water, valve access boxes that are full of water and perennially wet areas.

Each station or watering zone has a remote control valve. When the time clock activates a remote control valve, water flows from the mainline, through the valve and into the lateral lines that feed the sprinkler heads. Common valve problems include valves that won't turn on, valves that won't shut off and valves that don't quite turn off all the way. A valve that won't turn on may have an electrical malfunction in the clock, a break or short in the wiring, a malfunctioning solenoid or a broken metering pin. A valve that won't turn off may have a piece of debris preventing the diaphragm from closing. A flow control

that is out of adjustment can cause a valve to either not turn on or not shut off. A valve that turns off but not quite all the way is referred to as a weeping valve. A weeping valve is noticed by a small continuous flow of water exiting from the lowest sprinkler(s) in the watering zone. A weeping valve is usually the result of a damaged diaphragm or diaphragm seat. Malfunctioning valves can often be rebuilt but it may make more sense to replace them with new ones.

The remote control valves are wired to time clocks. Commercial landscape industry standards specify the use of 14 gauge direct burial wire. Lighter gauge multi strand wire is commonly used in single family residential settings but not recommended for commercial applications including homeowner associations. Properly installed wires, placed under the mainline and buried 18" deep don't often fail. Damaged wires are usually the result of a construction related excavation. Landscape industry standards also specify water tight connectors at the wire splices. A common cause of a valve not activating from the time clock is a bad wire splice.

The time clock is the key component to efficient irrigation programming. There are still a few old electro-mechanical units in use that should be upgraded. Those older units do not have the features demanded by current water conservation standards. Most time clocks now in use have solid state electronics rather than pins, dials, gears and wheels. Make sure that your time clocks have the minimum feature capabilities of "multiple programs" and "multiple cycle starts". Stations with similar watering requirements should be grouped together on a program and operated separately from other stations with different watering requirements. For example, turf may need watering four days per week where shrubs and groundcovers may only require water one or two days a week. With multiple programs, the turf stations and the shrub stations can be separated into two groups and be programmed independently.

Most sprinkler heads will apply water faster then most soils can absorb water. To minimize the runoff we use multiple cycle starts of shorter duration, allowing the water to soak in between applications.

The new buzz in the irrigation industry is "Smart Controllers". Brand names including Toro, Rain Dial, Weather Trac, Weathermatic, ET Water and Hunter have all introduced new versions of Smart Controllers this last season. The Irrigation Association defines a Smart Controller as climate-based or sensor-based controllers that automatically adjust for local weather and site conditions. California Assembly Bill 2717 mandates that all new commercial projects and all new HOAs over 25 units have irrigation systems that are equipped with Smart Controllers. Because these controllers readjust daily to adapt to current weather data, there is potential for substantial savings. Field studies have shown water use reductions exceeding 20%.

Another water saving device that is not new technology and is under utilized is a rain sensor. A rain sensor will interrupt the irrigation cycle in the event of rain. All time controller installations should be accompanied by a rain sensor. Some controllers with advanced features have a built in rain sensor.

Another advanced feature is remote testing. Remote testing is the ability to activate a remote control valve from a hand held transmitter, greatly reducing the time required to perform system checks and repairs. Most existing time clocks that do not have a remote testing feature can be retrofitted by installing a wiring harness to adapt to a remote activating device.

The final components to an irrigation system are the sprinkler heads. Sprinkler heads are the devises that apply the water to the landscape. They are the most visible part of the system and the most often damaged. There are spray heads, rotor heads and impact heads. Some heads are mounted above ground on fixed risers and other heads are buried to grade and pop-up when in use. Different types of sprinklers have different precipitation rates. The precipitation rate is the rate at which they apply water measured in inches per hour. To have an efficient irrigation system, all of the heads that run off the same valve need to have matched precipitation rates. Also, proper placement and spacing of heads is crucial to irrigation efficiency. Because sprinkler heads are so vulnerable to damage, system checks should be performed frequently. Check for broken parts and to be sure heads are aligned perpendicular to grade, set to grade and that the spray patterns are adjusted for the correct arc and radius.

An alternative to overhead spray systems is drip irrigation. Drip systems are most advantageous when plants are placed far enough apart to create areas between plants that don't require irrigation. Other drip system advantages are low precipitation rates that allow for deep watering without runoff and the elimination of overspray. When drip systems are used in densely planted landscapes, maintenance and repairs become difficult and time consuming because individual emitters can become hard to access and locate.

Different types of drip irrigation include the commonly used poly tubing with snap together compression or barbed fittings. This type of system is inexpensive and easy to install, but prone to damage requiring frequent repairs. There is a commercial grade drip system that is very durable utilizing heavy walled IPS tubing with solvent weld fitting connections and threaded emitter connections. Due to the higher cost of installation, these commercial grade systems are not common. A lower cost alternative system for commercial applications consists of standard rigid piping out letting into multi outlet emitters with small diameter "spaghetti" tubing running to individual plants. The down side to this alternative is that once the landscaping matures, tracing the spaghetti tubing from the multi outlet emitter to the individual plants becomes difficult, hindering maintenance and repairs especially in a densely planed landscape.

One type of drip irrigation system that is suitable for dense plantings uses special tubing that has built in emitters at pre-set intervals and is laid out in a grid pattern to provide complete coverage of the planted areas. With the emitters built into the tubing there are fewer parts and less chance of failure.

There is also a drip type system for turf areas. It is called the Turf Bubbler Wick Irrigation System and is manufactured by Nibco. All though this system is very effective, it is rarely seen because the installation cost is 2-3 times that of a conventional overhead spray system.