Winterizing Golf Course Irrigation Systems

October 1, 2018

Golf Water

Winterizing

- Winterization is the process of removing water out of an irrigation system to eliminate potential component damage caused by cold weather freezing.
- Winterization procedures are primarily performed in northern climates, but certain procedures should also be taken in southern climates to limit possible component damage (bridge/stream crossings etc.)

Golf Water

Why Winterize

- As water transitions from a liquid to a solid, a net expansion of volume of approximately 9% occurs. In a closed system, this generates “hoop stress” in pipe that will result in failure.

Golf Water

Why Winterize

Winterizing

- As important as developing a winterization procedure to safely evacuate water from a piping system is the procedure for ***gently*** repressuring the system as many system failures can be attributed to an aggressive start up that creates pressure surges related to water hammer.
- Since winterizing the system by gravity draining is seldom practical or even achievable, evacuating water with compressed air is usually the most efficient way to rid the system of water.
- As a note – a typical piping network will hold between 22,000-27,000 gallons of water which is the approximate volume of an in-ground swimming pool – that's a lot of water.

Golf Water

Develop a Plan

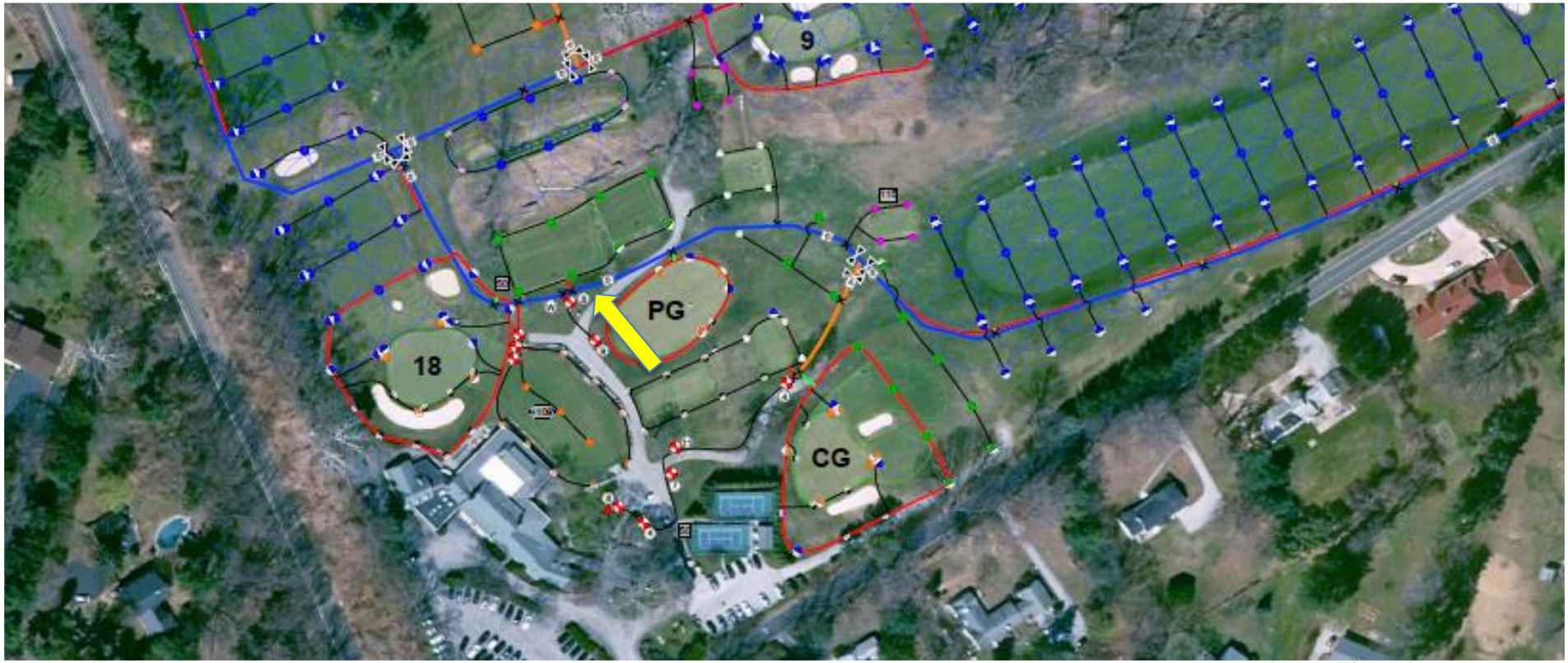
- Develop and document a plan for winterization so you can duplicate it the following year. Make it a living document that can be modified as you determine necessary.
- Use the As-Installed map to identify and the topography of the system (high and low spots) as well as **flag** the location of drains, quick couplers, isolation valves and air release/vacuum valves. This will help you quickly locate components.
- Locate location(s) where a compressor can be attached to the piping network.

Golf Water

Develop a Plan

Golf Water

Develop a Plan

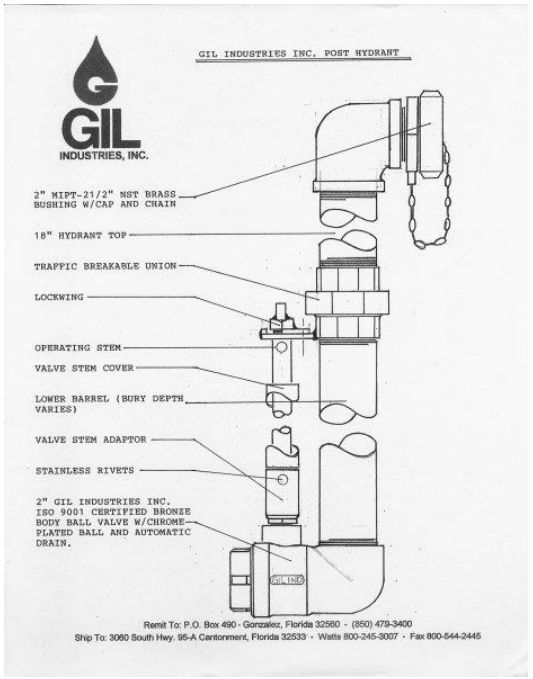


Golf Water

Develop a Plan

Golf Water

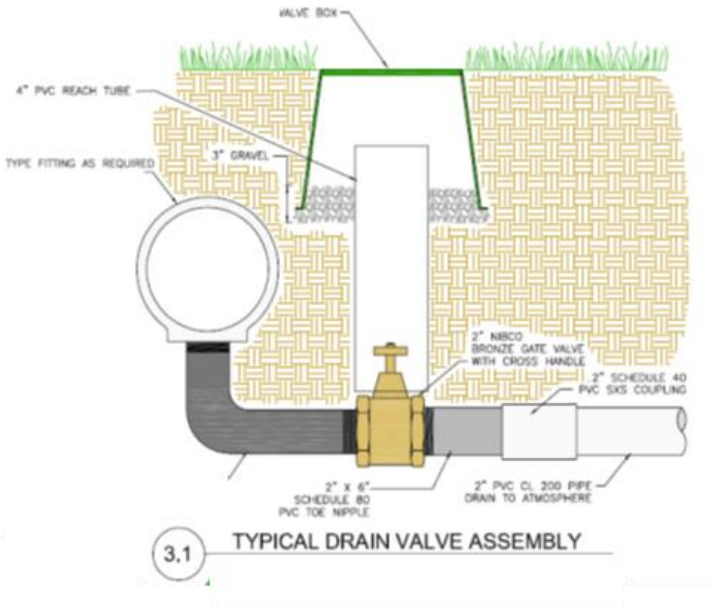
Develop a Plan



Golf Water

Develop a Plan

- Open drains two days prior to winterizing with compressed air.
  - Remove as much water from the system as possible
  - Ensure vacuum valves are operating and/or install quick coupler keys to allow air into the system to help drain
- If possible, find compressor location that is at a high elevation, accessible, and on large diameter pipe.



Golf Water

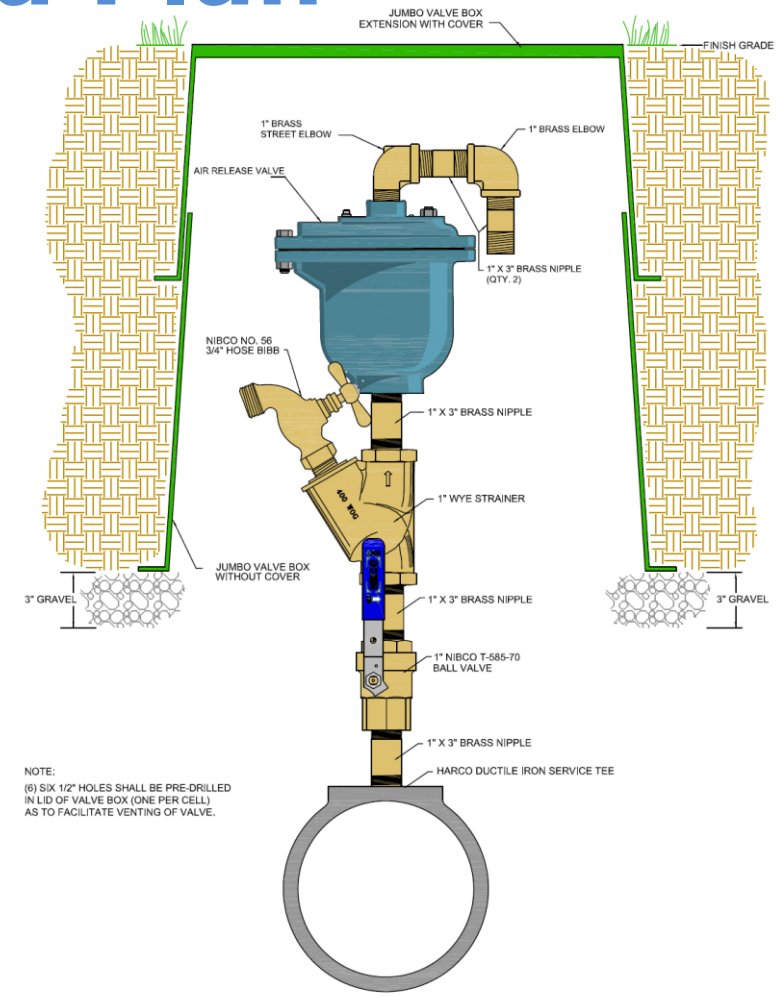
Develop a Plan

- In a closed piping system, the gulping of water is air being sucked into the pipeline and temporarily halting the flow. When a pipe is filled with water, it is at a particular pressure. When you open a drain, some water leaves, the pressure is now lower in the pipe. Once the pressure in the pipe is lower than atmospheric pressure, air forces it's way back into the pipe. This equalizes the pressure and water flows again. Then the pressure drops, air gets sucked in, and so on. Eventually all the water is gone and the pipe is filled with air at the same pressure as the atmosphere.
- Air vacuum valves or quick couplers help with equalizing pressure and allow water to flow from pipes more easily.

Golf Water

Develop a Plan

- Continuously acting Air/Vacuum valves allow air back into the system to help facilitate draining the pipeline. They are also helpful at keeping debris from getting sucked back into pipelines when there is system service or maintenance.



Golf Water

Air Compressor

- AIR VOLUME is the critical element NOT Air Pressure.
- Insufficient air volume can cause air to ride over top of the water.
- Too much air will cause heat to build and can cause a lot of damage
  - Dissipate heat with long hose
  - Connect into steel piping
  - 2” minimum connection
  - PVC fittings will melt
  - Use a pressure regulator

Golf Water

Compressed Air

Golf Water

Compressed Air

Golf Water

Compressor Size

- Air compressor performance is specified as the Cubic Feet per Minute, CFM, at a given pressure
- How big should the compressor be?
  - Typically 25 - 40% of pump station capacity.
  - 1500 GPM system may use a 375 – 600 CFM compressor.
  - Availability is often the driving factor.
  - I often see a few golf courses share the rent of a compressor for several weeks.
  - Safety features are very important.

Golf Water

Selecting a Compressor

Golf Water

Pressure Regulator

- Use a pressure regulator set at factory recommended pressure (40-60 psi)
- Safety Controls
  - Ensure compressor is equipped with the appropriate safeties.
  - Adjustable pressure relief valve.
  - Flow regulating control valve.
  - Pressure gauges.
  - *Air & Oil Separator

2” Parker 09R813BA with pressure gauge, brass fittings and hose connection ~$850

Golf Water

Blow Out Procedure

- Proper sequencing will require 3-5 crew members.
  - One to monitor the compressor at all times
  - 2-4 to activate sprinklers. Each crew member should have a pressure gauge to check pressure at quick coupler locations and to call back to the compressor if adjustments need to be made
- Air Pressure
  - Keep pressure regulation below 60 PSI
  - Water is relatively incompressible however, Air is VERY compressible and can reach pressures upwards of 500-600 PSI
  - **DANGER!!** – Do not stand over pressurized sprinklers and valves.

Golf Water

Procedure

- Point of Connection
  - **Do not** attempt to blow air back through a pump or backflow prevention device. **Keep the discharge isolation valves closed.**
  - Use elevation to your advantage.
  - Connect at the highest point possible to a 2 inch or larger connection and a large mainline pipe.
  - Steel connection is preferred. Serious damage to PVC components can occur.
  - The pump discharge drop pipe is often used or a field hydrant.
  - Longer air hose will dissipate the heat better.

Golf Water

How many heads to Operate?

- Using quick couplers, set up some pressure gauges in the field to monitor pressure and adjust pressure at the compressor as required
- Always keep a valve or outlet open at all times and constantly manage pressure in the system with pressure gauges.

Golf Water

How many heads to Operate?

- As a guideline, the following table illustrates the expected CFM of a sprinkler

	Sprinkler CFM Use		
	Nozzle	35 PSI	50 PSI
	51	23	28
50-65’ Sprinkler	52	30	33
	53	35	38
	54	43	48
	55	48	53
	56	50	55
75-80’ Sprinkler	57	53	58
	58	59	64
	59	65	70

Golf Water

Blow-Out Procedure

- Close the air release valves.
- Keep a couple drain points open and close the rest.
- Note – One outlet should always be open when the system is under pressure.

Golf Water

Blow-Out Procedure

- Pressurizing the lines
  - Only skilled operators should use air compressors.
  - Monitor Pressure gauges at all times.
  - Keep pressure in the range of 40 – 60 PSI.
  - Use portable pressure gauge to monitor remote areas
  - Be Patient - It may take 30+ minutes to charge the system.

Golf Water

Blow-Out Procedure

- How to Activate Stations:
  - Manually at sprinkler or valve.
  - Hand held radio.
  - Cellular phone with application software.
  - Satellite controller.
  - Manually at Central Control.
  - Automatic Programs at Central Control.

Golf Water

Blow-Out Procedure

- Controlling The Process
  - Begin with blowing out zones furthest from the compressor, and at the highest elevation points first.
  - Eliminating water at higher elevations reduces the likelihood of water running back into those zones.
  - Continue activating zones working back toward the compressor and finish with lower elevation zones.
  - Verify proper pressure with manual gauge in areas that are being blown out.

Golf Water

Blow-Out Procedure

- Controlling The Process
  - Run zones for *2 – 3 minute cycles.
  - Multiple short cycles is more effective than fewer long cycles.
  - Close zone valves after repeated short cycles and only mist is coming out of the sprinklers.
  - Complete the same process with all zones and proceed with shutting down for the day.

Golf Water

Blow-Out Procedure

- Compressor Shutdown
  - Slowly close the flow control valve on the compressor until air flow stops.
  - Shut off the compressor for the night.
  - Make sure all low elevation drain valves remain open overnight to allow water to gravity drain.
  - Do not disconnect the compressor unless all pressure is relieved from the system.

Golf Water

Blow-Out Procedure

- Winterization Continued
  - The average system takes 2 – 3 days to properly winterize.
  - Re-open any closed zone valves
  - Go through the same process as day one.
  - Each zone should require fewer cycles.
  - Properly shutdown compressor and safely disconnect when pressure is relieved.

Golf Water

Final Steps

- After the blow-out process is complete
  - Close all open drain valves.
  - Open all air relief valves.
  - Keep satellite controllers powered on to reduce condensation build up and corrosion. Make sure they are weather resistant
  - Run weekly programs to activate solenoids.
  - Control Rodent/Insect Infestations – Install new Nuvan Strips
  - Service Weather Stations and Rain Cans.
  - Check grounding and enhance where necessary.

Golf Water

Final Steps

Golf Water

Start-Up

- A lot of damage to a piping network can occur at start-up. Uncontrolled velocities and compressed air in pipelines can create terrific water hammer that can burst pipes. The "slow-fill" routine on a pump station often assumes that most of the pipelines are full and therefore flow ramps up too dramatically.
- A good guideline is to fill empty pipelines at 1-1 ½ feet per second.
- PVC pipe systems are not designed for compressed air and great care must be taken to eliminate water hammer.

Golf Water

Fill/Recharge Rates

- Typical fill rates based on pipe size:

Pipe Size	GPM	Velocity (feet per second)
1”	5	1.50
1½”	10	1.41
2”	20	1.80
2½”	30	1.84
3”	45	1.86
4”	75	1.87
6”	150	1.73
>=8”	200	<1.50

Golf Water

Start-Up

- Close mainline valves so sections can be brought on slowly
- Close lateral valves and ensure all air release valves are open
- Open drain valves in each section of mainline that is brought on and close when air has been removed from the pipeline
- Install quick couplers on high areas to help vent air
- Start filling mainlines and open valves as sections are filled, moving away from the pump house.
- Open lateral lines and manually throttle valve as lines fill while “last head” is turned on to vent air.
- Once system is filled, manually operate each head to purge air from swing joints.

Golf Water

Start-Up

- Slowly open and fill lateral lines. Open a quick coupler or turn on end sprinkler(s) to purge air.
- Operate each sprinkler and quick coupler to ensure air is purged from swing joints .
- Recheck each controller to ensure it is operating with the central control system.
- Filling the system should take 2-3 days.

Golf Water

Winterizing Golf Course Irrigation Systems

October 1, 2018

Golf Water