GEISERMISER

Save Water When Sprinklers Break

Product Testing Program

Single-Unit Testing

Zone-Level Testing

Compressed Air Blow-Out Testing

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Test Program Objectives

The GeiserMiser is a new product that solves a long-standing problem in irrigation networks: how to cost-effectively stop the large amount of water-loss that can occur when riser components 1) inevitably fail, break or are damaged, and 2) are not immediately repaired.

AmLee Innovations, our distributors, partners and customers who install and use the GeiserMiser in residential and commercial irrigation systems need to completely understand specific unit-level performance characteristics, as well as overall effect on zone and system performance.

Further, of particular interest is how the GeiserMiser performs within compressed air blow-out winterization processes which regularly occur in northern climates.

The objective of this program is to clarify these two important points of interest for people who currently use or are interested in using the GeiserMiser in their systems.

To this end, the test program outlined below represents the specifications and tests that AmLee Innovations set up and performed on the GeiserMiser ½-inch product. Additionally, this program will be used for all future versions and sizes of the GeiserMiser product line.

1 Single-Unit Testing

The following tests were conducted to qualify how single GeiserMiser units perform under various operating conditions.

1.1 Pressure Testing

AmLee Innovations has put GeiserMiser through several series of pressure tests to measure its failure point. Initially we tested the product in conjunction with typical irrigation components (PVC supply lines, T-fittings, nipples, pop-ups, etc.) but could not reach the failure point of the GeiserMiser, we kept bursting other components first. Finally we tested the GeiserMiser in a pressure testing chamber, where it reached 550 PSI before failing along the bottom of the unit. The 550 PSI failure point is a consistent measure across several product tests.

1.2 Non-Potable & Septic System Testing

To ensure that the GeiserMiser performs as claimed, and as specified by the component performance capabilities, AmLee Innovations installed an early-manufacture GeiserMiser unit in a residential anaerobic septic system drainage line for **four years**. After the 4-year period was completed, we dug the unit up and cut it open to determine if any inside contents had accumulated. No material was present in the GeiserMiser unit. It was not clogged, and no plant growth or debris was caught anywhere within the unit. This unit performed for over four years with no issue or clogging in a septic system. Further, this GeiserMiser unit regularly activated to prevent floods of septic water from the attached down-stream horizontal line which frequently cracked or severed (it ran shallowly-dug below a heavy-traffic gravel driveway).

Pictures taken Dec 16, 2009

(No clogged sludge, deposits, or hanging debris)

(**closeup**: negligible buildup after 4 years)

1.3 Calcification and Deposits Testing

AmLee Innovations also installed an early-manufacture GeiserMiser unit in a residential irrigation system that is tied to a municipal water source. We allowed it to operate for **four years** to determine if calcium and mineral deposits would occur, and if it would negatively impact the performance of the unit. After the 4-year period was completed, we dug the unit up and cut it open to determine if any inside contents had accumulated. Negligible calcium and mineral deposits were present on the ball, spring, or inner cavity of the unit. No other material was present in the GeiserMiser unit. It was not clogged, and no plant growth or debris was caught anywhere within the unit.

This unit performed for over four years with no issue or clogging in this municipal-supplied residential irrigation system. Further, this GeiserMiser unit regularly activated to prevent floods of water onto a driveway. It was installed in a high-traffic corner intersecting a sidewalk and a driveway. The unit was subject to years of lawn equipment, cars parking and running over it, winter freezes and all other typical environmental scenarios within the 4-year period, and activated on average once a year to prevent water floods.

The pictures on the next page provide a good example of the product performance in an extended application within a typical irrigation system that is neglected and un-maintained by the owners/operators. The GeiserMiser is designed to be installed and forgotten, with years of reliable water-saving performance.

Pictures taken Jan 18, 2010

(No debris buildup at the inner-top of the unit)

(no debris buildup at the bottom of the unit)

Special Note: Notice the empty space within the unit. The inner cavity is quite large, allowing ½ an inch in all directions for water and debris to flow around the ball and spring assembly.

(Negligible deposits at the bottom of the unit)


(No debris buildup at the spring)

1.4 Sand Clog Testing

AmLee Innovations has put the GeiserMiser though several sand clog tests, across a variety of sand grades. Across these, our sand tests did not clog the GeiserMiser, and did not prevent the GeiserMiser from activating at 6 GPM to stop the flow of a geyser. Special sand tests we also conducted included clumpy sand, and small pebbles.

Special Note: The GeiserMiser inner cavity is quite large, and debris passes through it with ease. Our ball is 1-inch in diameter, yet the fully-assembled inner cavity is over 1 5/8-inch wide and about the same tall.

2 Zone-Level Testing

The following tests were conducted to qualify how GeiserMiser units perform within an entire zone, across multiple sprinkler heads.

Zone Test Specifications and Configurations

Specifications

Number of zones to mock up:	2
Number of sprinkler heads per zone:	6
Number of GeiserMiser units in the test:	around 12 to 15
Minimum flow rate per head:	None
Maximum Flow rate per head:	**6 GPM**
Pipe size to use for sprinkler risers:	½-inch
Pipe size to use for supply line:	no preference
Average supply line length between heads:	20 feet
Variability in supply line length between heads:	+/- 10 feet

Zone Configuration and Types of Components to use:

1. ***Zone 1:*** *Horizontal supply line, negligible line slope*
    a. **Turf mock-up**
        1. Hunter 6-inch popup, 360° throw radius, with swing joint
        2. Rainbird rotor head, 180° throw radius, no swing joint
        3. Hunter 12-inch popup, 90° throw radius, with flexible/funny pipe
        4. Toro impact head, 360° throw radius, with swing joint
    b. **Shrub mock-up**
        5. Rainbird nozzle, 90° throw radius, 3-feet of nipple height
        6. Toro nozzle, 180° throw radius, 2-feet of nipple height
2. ***Zone 2:*** *Angled supply line… multiple series of 15° line slopes*
   (a long zig-zagging supply line, where the water flows UP, and then flows DOWN, etc.)
    a. **Turf mock-up:** same as zone 1
    b. **Shrub mock-up:** same as zone 1

Note: All tests in outlined should be performed for each of our two test zones (horizontal and angled).

Tests to Run

All tests outlined should be performed for each of our two test zones (horizontal and angled).

Zone Test 1: All sprinklers have a GeiserMiser underneath.

All risers should have a GeiserMiser unit installed below the sprinkler and nipple, at the supply-line's t-fitting.

2.1 Normal watering cycle

These tests should be performed for both test zones set up (horizontal and angled)

2.1.1 Turn water flow on for a period of 3 minutes or longer.

Expected outcome:

a. During the first minute or two, the GeiserMiser units may cycle through, or activate/deactivate a few times as the pressure and flow regulates throughout the zone. This is normal.
b. Once pressure and flow regulates, all sprinklers will water normally.
c. All installed GeiserMiser units allow water to pass through to the heads for a normal watering cycle.

2.1.2 Turn water flow off.

Expected outcome:

a. All sprinkler heads stop watering and collapse back into their housings.
b. All installed GeiserMiser units 'reset', allowing all remaining water within the riser to slowly pass back into the supply line.

Note 1: The entire riser section (sprinkler heads, nozzles, swing joints, nipples, etc.) will be slowly drained of water, leaving no water within their internal cavities. It can take between 30 and 90 seconds for the water to completely drain out of the riser, depending on the size and length of the nipple and sprinkler head.

2.1.3 Repeat steps as needed for additional testing procedures and observations.

2.2 Normal watering, but with one or more broken sprinklers

2.2.1 Turn water flow on for a period of 3 minutes or longer.

Expected outcome: same as section 1.1.1

2.2.2 While zone is watering, inflect damage to **one** of the risers in the zone (sprinkler head, nozzle, swing joint, nipple, etc.)

Some suggestions for damage:

- Cut a nipple completely or partially off with some hedge or branch trimmers.
- Cut a nozzle completely or partially off.
- Place a sprinkler head within a pair of vice clamps and tighten until it cracks.
- Run over a head with a lawn mower or vehicle
- Feel free to be creative☺

Expected outcome:

a. The GeiserMiser automatically activates and completely shuts off water flow to the damaged riser. The damaged riser will no longer pass water for the rest of that zone cycle. **Note:** Depending on the water flow rate within the broken riser, the GeiserMiser will either instantly shut off, or ratchet on/off briefly until pressure re-regulates in the zone.
b. Overall zone pressure is preserved.
c. All remaining/undamaged heads in the zone continue watering normally.

2.2.3 Turn water flow off.

Expected outcome:

a. All GeiserMiser units automatically 'reset', allowing remaining water within the risers to slowly pass back into the supply line, *including the damaged riser*.
b. All sprinkler heads stop watering and collapse back into their housings.

2.2.4 Turn water back on, without repairing the damaged riser components.

Expected outcome for all undamaged risers:

a. During the first minute or two, all the GeiserMiser units may cycle through, or activate/deactivate a few times as the pressure and flow regulates throughout the zone. This is normal.
b. Once pressure and flow regulates, all undamaged sprinklers will water normally.
c. This is the same as section 1.1.1

Expected outcome for the damaged riser(s):

a. **During the first minute or two** as zone pressure and flow regulates, this GeiserMiser unit may also cycle through, or activate/deactivate a few times, and water may leak out of the broken riser**. This is also normal, and allows owners**

or maintenance professionals to observe the damaged riser that needs repaired.

b. However, once pressure and flow regulates within the zone, the GeiserMiser unit underneath the damaged riser automatically activates again and completely shuts off water flow to the damaged riser. The damaged riser will no longer pass water for the rest of that zone cycle.
c. Overall Zone pressure is preserved.
d. All remaining undamaged risers water normally through full cycle length.

2.2.5 While zone is watering, inflect damage to **a second** riser in the zone (sprinkler head, nozzle, swing joint, nipple, etc.)

Expected outcome: same as section 1.2.2

2.2.6 **Repair damage while the zone is on!** Leave zone on (there are now two damaged heads in the zone). While the zone continues watering, perform a repair of one or both of the damaged riser components. But make sure that the GeiserMiser remains screwed/secured into the supply-line t-Fitting!

Expected outcome:

a. The GeiserMiser keeps water flow shut-off at that damaged riser and allows repairs to be made with no lost or wasted water.
b. When the repair is complete, The GeiserMiser will still be activated and water will continue to be shut-off at that head.
c. The zone will continue watering as before the repair began through the rest of the zone cycle. Overall Zone pressure also remains preserved.

2.2.7 Turn water flow off again.

Expected outcome: Same as section 1.2.3

2.2.8 Turn water flow back on. One or more of the damaged risers have been repaired.

Expected outcome: Same as section 1.2.4

2.2.9 Repeat steps as needed for additional testing procedures and observations.

2.3 Compressed-Air Winterization (Cold Climates)

a. Appendix A outlines a typical professional winterization process[1].

We recommend using Appendix A as a reference to the methods used for blowing out irrigation lines with compressed-air.

Expected outcomes will be that the GeiserMiser allows compressed-air to push water out of the lines, but it may take a bit of trial & error to get the right PSI-to-water flow relationship right.

Measurements to define in the test
AmLee Innovations, and our distributors and customers who employ compressed-air winterization methods need to understand how the GeiserMiser performs in these processes. Through these tests we need defined:

1. At what PSI level prompts a single GeiserMiser unit to activate
2. For test zones that have GeiserMiser units installed underneath ALL risers:
    a. What PSI level allows the zone to be completely and successfully expelled of water?
    b. Were there noteworthy events or anomalies that occurred?
    c. What PSI level prompts ALL GeiserMiser units to activate and shut off flow?
    d. What PSI level prompts at least one GeiserMiser unit, but not all, to activate?
    e. If one GeiserMiser activates, does it affect other risers in a negative way?
    f. If some GeiserMiser units activate while at least one remains inactivated, does the compressed air successfully expel water from the zone?
3. Repeat the same test as in (2), but with GeiserMiser units installed underneath SOME, but NOT all risers.

[1] http://www.irrigationtutorials.com/winter.htm

2.4 Spring Start-Up and Flushing

a. Appendix B outlines a typical Spring Start-Up process[2].

We recommend using Appendix B as a guide to what needs testing.
We recommend using Appendix B as a reference to the methods used for re-configuring and preparing for a new season, after a winter season completes.

Expected outcomes will be that the GeiserMiser allows spring start-up processes to complete, but there may be some additional things to note or be aware of that we want these tests to discover and describe.

Measurements to define in the test
AmLee Innovations, and our distributors and customers who engage in typical spring re-configuration methods need to understand how the GeiserMiser performs in these processes. Through these tests we need defined:

1. When a zone undergoes a flushing out, how do the GeiserMiser units respond?
2. Is there a difference in the flushing results between zones with ALL GeiserMiser units installed and those with just SOME, but not all?

Zone Test 2: Only some sprinklers have GeiserMiser underneath

This test will be conducted exactly as Test Group 1, except that some risers will have their GeiserMiser units removed, and some risers will continue to have a GeiserMiser unit installed underneath.

Test outcomes should be the same as in Test Group 1 tests for all risers having a GeiserMiser installed underneath. But for damaged risers without a GeiserMiser underneath, all the undesirable consequences will be observed:

- Wasted water
- Lost zone pressure and severely degraded watering coverage
- Risk of flood or erosion damage
- Risk of personal injury or property damage
- Risk of municipal fines & tickets
- Spikes in water/utility bill
- Public embarrassment by property or network owner

[2] http://www.irrigationtutorials.com/winter.htm

Appendix A: Compressed Air Blow-Out Winterization Process

The Blown/Compressed Air method:
This is not a method for amateurs or average "do-it-yourselfers". Almost all big sprinkler systems such as golf courses and parks are winterized using compressed air. But one tiny little mistake can cause severe line blowouts.

1) Shut off the water supply to the irrigation system.

2) Typically, very large air compressors are used for this method. A small irrigation system (3/4" PVC pipe or 1" poly pipe) will need at least a 20 cubic feet per minute air compressor, but it's recommended to use a 50 cubic feet per minute compressor or larger for typical home sprinkler systems. Professionals often use a large gas or diesel powered compressor that can discharge over 125 cubic feet per minute of air and can blow out a pipe as large as 3" diameter. Note: SCFM means "Standard Cubic Feet per Minute" and for our purposes here, it's the same thing as CFM. SCFM is a measure of CFM at a specific temperature and altitude.

    a. NEVER use an air tank filled with compressed air or gas. Do not attempt to create more air flow by filling an air tank, then attempting to blow out the system with large bursts of air from the tank.

3) Start by removing the backflow preventer (for anti-siphon valves remove the whole valve). It's optional but recommended to install a blow out fitting (usually a tee with a 1" side outlet, and a short length of pipe with a threaded cap on it) to connect the compressor up to right after that shut off valve.

4) Next, connect the air compressor to the backflow preventer riser (on the downstream side), but do not turn it on yet. Do not blow air directly through the backflow preventer or through a pump, as they could be damaged. It is important that the air compressor has a pressure regulator valve with an accurate gauge on it.

5) Safety first! Plastic pipe is not designed to hold compressed air. In narrow confined spaces, air does not behave the same as water. If the air becomes trapped by a pocket of water in the pipes it can suddenly "burp" free with enough force to explode the sprinkler heads. Always increase the air pressure in the pipes slowly. Never attempt to blast out the water with a sudden burst of air. If the water cannot be pushed out with a steady flow of air, then a higher capacity air compressor is needed.

6) Using the automatic controller/timer, turn on the last valve, that is furthest from the backflow preventer. Only turn on one valve at a time. If one valve is considerably higher in elevation than the others you may want to start with it rather than the last valve. But in most cases the

last valve is the first one that should be blown out. If manual valves are installed just open them manually. If have anti-siphon valves are installed, then they either need to be removed or the compressor needs to be hooked up downstream from them.

7) Turn on the compressor and slowly increase the pressure. Carefully monitor the air pressure, never allowing the pressure in the irrigation system to exceed 50 PSI. You probably won't even need 50 PSI to blow out all the water. The lower you can keep the pressure, the better.

    a. Watch the temperature also. Air heats up as it is compressed. The air can get quite hot when it leaves the air compressor, hot enough to melt the plastic sprinkler pipe. It may be necessary to add some extra length of hose between the compressor and the connection to the sprinkler system so the air can cool a bit before entering the sprinkler system piping.

8) Allow the air to run until all the water is blown out and only air is exiting through the sprinkler heads. Don't blow air through the system any longer than necessary.

    a. If it takes more than 2-3 minutes for the water to get out, stop the compressor and let everything cool down for a few minutes, then start again. Be patient, and keep watching the pressure and temperature. The first valve will probably take a lot longer to blow out than the others because most of the water in the mainline pipes gets blown out of the first valve zone.

9) After only air is coming out of the sprinklers, turn off the air compressor, and turn off that valve. Open the next valve, turn the compressor back on and repeat the blow-out procedure. Continue until all the valve circuits have been blown out. Note that if you have anti-siphon valves you will need to switch the compressor hose to the next valve riser.

10) Never turn off all of the valves while the compressor is running! At least one valve must be open at all times, otherwise the sprinkler lines will probably burst.

11) When all the valves have been blown out it is a good idea to repeat the entire process again, starting with the first valve.

12) When the system blow-out is completed, turn the automatic controller off, or move it into "rain mode". Store the backflow preventer inside for the winter. Install threaded caps over all of the following, to ensure garbage, bugs, animals, etc. stay out of the lines during winter:
    a. Open ends of the backflow preventer risers
    b. Anti-siphon valve risers
    c. All Sprinkler Heads and Blow-Out fittings

Appendix B: Spring Start-Up and Flushing Process

Spring start-up is just as important as winterization, but often neglected or shortened. Over winter many things get into the system, and need to be pushed or flushed out.

1) When the sprinkler system is turned back on in spring first thing should be to flush it out. Remove all nozzles from sprinklers, or at the least from the last head on each zone. Turn the water on. When you think the water has run long enough, you're only half way done. Let it run twice that long! The biggest mistake in flushing is not letting the water run long enough.

    a. When done, make sure that standing water doesn't drain back into the pipes, taking dirt back in with it! You may need to put a temporary piece of hose or pipe onto the flush outlet to drain the water to a different area. Make sure the hose is as big or bigger than the pipe, you don't want to restrict the flow!

2) After flushing, reinstall all nozzles and replace all broken ones. Check the system by running it again. Look for clogged emitters or nozzles and replace.

3) Check for leaking valves. Often the flexible seals dry out over the winter and leak when the water is turned back on.

4) Check the controller for proper run times for each station. If it has a back-up battery replace it with a fresh one.