

# 1 Zone-Level Testing

The following tests were conducted to qualify how HydroKnot 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 HydroKnot 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 HydroKnot underneath.

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

## 1.1 Normal watering cycle

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

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

Expected outcome:

- a. During the first minute or two, the HydroKnot 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 HydroKnot units allow water to pass through to the heads for a normal watering cycle.

1.1.2 Turn water flow off.

Expected outcome:

- a. All sprinkler heads stop watering and collapse back into their housings.
- b. All installed HydroKnot 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.

### 1.1.3 Repeat steps as needed for additional testing procedures and observations. Normal watering, but with one or more broken sprinklers

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

Expected outcome: same as section 1.1.1

1.1.5 While zone is watering, inflict 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 HydroKnot 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 HydroKnot 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.

1.1.6 Turn water flow off.

Expected outcome:

- a. All HydroKnot units automatically 'reset', allowing remaining water within the risers to

- c. Slowly pass back into the supply line, *including the damaged riser*.
- d. All sprinkler heads stop watering and collapse back into their housings.

1.1.7 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 HydroKnot 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 HydroKnot 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 HydroKnot 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.

1.1.8 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

1.1.9 **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 HydroKnot remains screwed/secured into the supply-line t-Fitting!

Expected outcome:

- a. The HydroKnot 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 HydroKnot 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.

1.1.10 Turn water flow off again.

Expected outcome: Same as section 1.2.3

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

Expected outcome: Same as section 1.2.4

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