Smart Water Application Technologies (SWAT)™

Pop-up Sprinkler Head Check Valves

Equipment Functionality Test Protocol

Version 2.3

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Test Protocol
Smart Water Application Technologies (SWAT)™
Pop-up Sprinkler Head Check Valves

1 Scope

This testing protocol specifies the performance requirements and test methods for sprinkler head check valves, intended for operation in irrigation systems, with water at temperatures not exceeding 122° F (50° C), which may contain fertilizers and other chemicals of the types and concentrations used in irrigation systems.

The testing protocol applies to spring-loaded, hydraulically-operated valves of ½ NPT size or greater which are designed for fully open and fully closed operation. The system pressure to achieve the fully open position is determined by selection of valve internal components and may be adjustable. The valve components are integral to the sprinkler head body. This protocol does not apply to valve-in-head sprinklers.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document applies.

ANSI/ASME B1.20.1-1983 (R1992). Pipe Threads, General purpose

3 Terms and definitions

For purposes of this document, the following apply:

3.1 Check valve

Valve which automatically opens by fluid flow in a defined direction and which automatically closes to prevent fluid flow in the reverse direction

3.2 Leak-tight

No visible weeping or formation of drops or bubbles

3.3 Pop-up sprinkler

Sprinkler designed for installation so that the sprinkler nozzle is at or below ground level when it is not pressurized and above ground level when it is pressurized

3.4 Pop-up/pop-down mechanism

Mechanism within the sprinkler that automatically raises the nozzle height to improve crop clearance when the system is pressurized and automatically lowers the nozzle to the original position when the system is de-pressurized

3.5 Operating element

Component of the device by which the mechanical power is introduced

3.6 Nominal pressure

Convenient numerical designation for, and the approximate equivalent of, the maximum pressure that a check valve will operate at a test water temperature specified by the manufacturer, typically 72° F (22.2° C)

NOTE: Definition is included to help clarify a commonly misapplied concept in discussions of valve technology.

3.7 Set pressure

The inlet pressure (feet of head or elevation) that causes the sprinkler to completely pop up

3.8 Cracking pressure

The pressure (feet of head or elevation) at which the check valve starts to leak

4 Design Requirements

4.1 Materials

4.1.1 Components

Valve parts that are in contact with water shall be of non-toxic materials and resistant to fertilizers and other chemicals of the types and concentrations used in turf and agricultural irrigation. Valves shall be designed for service temperatures from 32° F (0° C) to 122° F (50° C).

4.1.2 Elastomers

Elastomers shall be selected as suitable for the application. They shall possess good sealing qualities and be resistant to deterioration by water and water-born fertilizers and chemicals.

4.2 Pressures

The nominal pressure rating and test pressure rating must be the same.

4.3 End connections

Pop-up sprinkler inlet connections incorporate ANSI/ASME B1.20.1-1983 (R1992) Tapered Pipe Threads.

4.4 Maximum water velocity

Valves shall be designed for maximum water flow velocities of 15 fps (see Note) in steady flow conditions.

NOTE: To verify that this velocity requirement has been met, calculate the velocity using the actual cross sectional area of the valve inlet and the maximum rated flow rate of the assembly as declared by the manufacturer.

5 Performance requirements

NOTE: All performance testing to be conducted in a lab with room and water temperatures of 72° F ± 4° F (22.2° C ± 2° C). Water to be filtered through a 200-mesh screen.

5.1 Mechanical strength

5.1.1 Resistance to internal pressure of all pressure-containing components (see Annex D)

The check valve and all internal components shall withstand without visible damage an internal pressure of 1.5 times the maximum allowable operating pressure as declared by the manufacturer.

5.2 Pressure loss (see Annex E)

The pressure loss measured at the full open position and a particular flow rate shall not exceed the pressure loss declared by the manufacturer at that same flow rate by more than 5%. If no pressure loss is declared, the measured pressure loss is noted in the performance report.

5.3 Water tightness

5.3.1 Short term seat tightness (see Annex A)

The seat of sprinkler head check valves in the fully closed position shall be leak-tight when subjected to an inlet pressure of 75% of the manufacturer's declared cracking pressure when tested in both the vertical and non-vertical orientation. Leak-tight is interpreted to mean no visible weeping or formation of drops at the bleed hole (shown in Figure 1) after subjecting the valve to pressure for a period of 1.0 hours.

5.3.2 Cracking and set pressure

Sprinkler head check valve shall be tested for cracking and set pressure in accordance with the test procedure given in Annex A.

Check valves shall have a cracking pressure within ±10% of the manufacturer's specified value.

5.3.3 Long-term seat tightness

Sprinkler head check valve shall be tested for long-term seat tightness in accordance with the test procedure given in Annex B.

Sprinkler head check valve shall retain a minimum of 50% of the test pressure set in accordance with Annex B.

5.4 Endurance test

Sprinkler head check valve shall keep its functional capability after being subjected to 2,500 cycles of operation in accordance with Annex C.

In order to verify these requirements, the valve shall pass the water tightness tests in accordance with 5.3.1, 5.3.2 and 5.3.3 following the test.

Dismantle the valve and check visually for failure of any valve components. Failure is defined as fractures or changes in geometric configuration.

6 Conformity assessment

6.1 General

The conformity of products to the relevant part of this test protocol shall be demonstrated by:

- Carrying out all the tests specified to ensure that all fitness for purpose criteria are met; and,
- Controlling the production process in order to ensure that the required performance levels are continuously met.

7.0 Marking

The following marks shall be compulsory

- Part identification
- Manufacturer
- Check valve or commonly used commercial equivalents e.g. “SAM” or “COM.”

8.0 Test Sample Requirements

To be listed as a SWAT tested product, the testing laboratory will obtain ten sprinklers with integral check valves from three different stores for a total of 30 units. Five samples will be randomly selected from the lot for testing. To have the results posted, all five units must comply with the manufacturer’s claims of performance.

The results will be reported for:

- Measured values compared to declared values
- Head loss through the check valve

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Annex A (Normative)

Test method for determining a pop-up sprinkler head check valve's cracking and set pressures in vertical and non-vertical orientation

Reference is made to Figure 1 and the following procedure for determining a valve's set and cracking pressures.

A.1 Mount the pop-up sprinkler head check valve to be tested at the location shown in Figure 1.

A.2 Close control valve

A.3 Connect a water supply to the flow meter inlet. Minimum sustained pressure required, 50 psi

A.4 Open control valve to provide a gauge reading of 2.0 psi

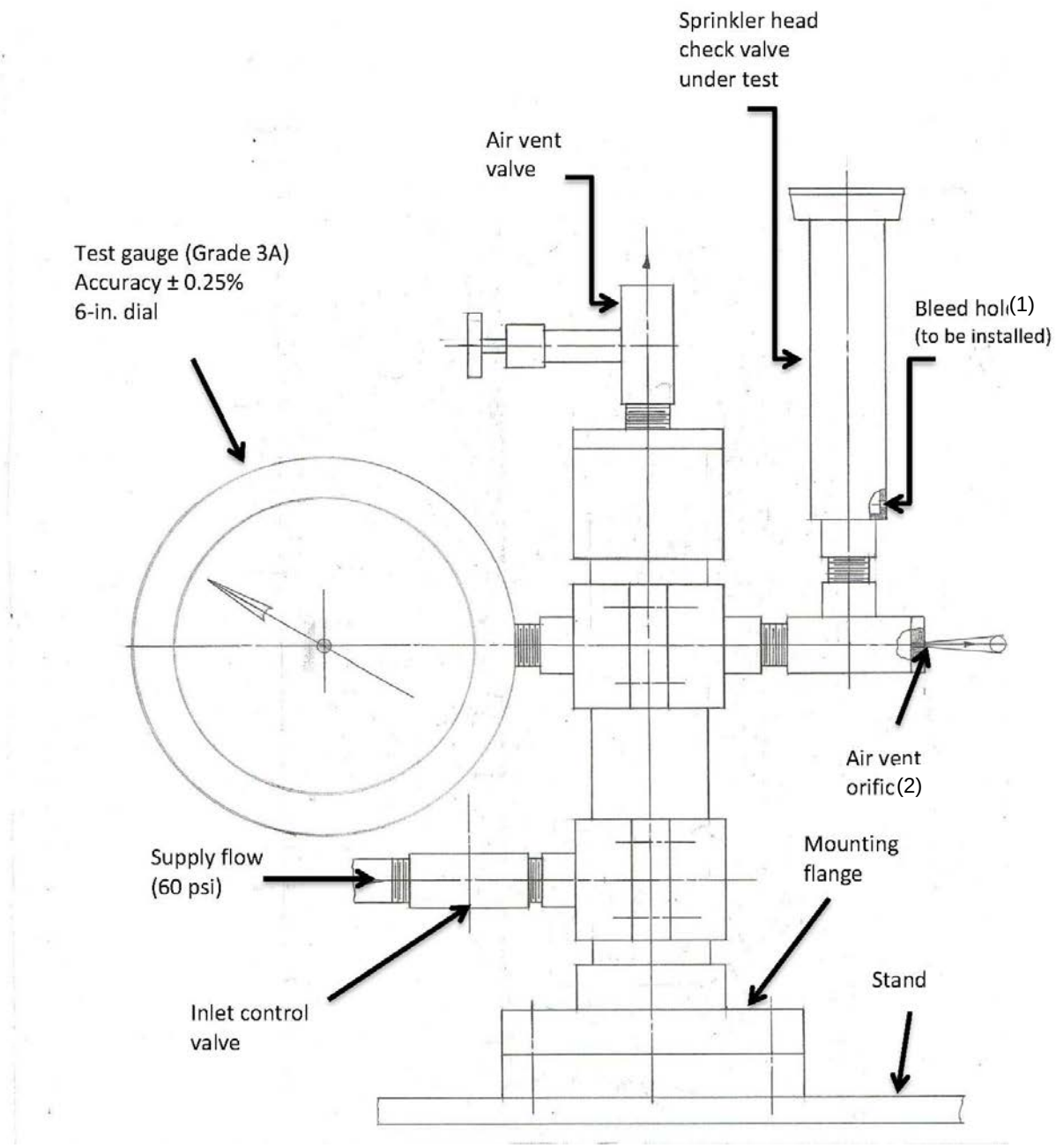
A.5 Open air bleed valve until air is evacuated; close valve

A.6 Slowly raise the water pressure until water is detected through the bleed hole. Note the pressure reading (up cracking pressure)

A.7 Continue to raise the pressure until the pop-up feature reaches the full pop-up position and note the pop-up pressure reading (set pressure)

A.8 Slowly lower the water pressure until no water is detected exiting through the bleed hole. Allow sufficient time between observations to ensure that discharge through the bleed hole is not the result of water that was stored in the sprinkler housing. Note the pop-down pressure reading (down cracking pressure)

A.9 Set the test pressure (or equivalent feet of head or elevation) at the manufacturer's published value**,** and then slowly tilt the testing apparatus axis to 15°, 30° and 45° from the vertical position and hold for two minutes at each angle. Note the angle at which leakage occurs. Reduce the pressure to zero thereby stopping the leak. Gradually raise the water supply pressure and note the value when leakage again occurs.



(1) Bleed hole, $^1/_8$ in. d
(2) Air vent orifice, $^1/_{32}$ in. d

Figure 1. Apparatus for pressure and leak testing of valves

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Annex B (Normative)

Test method for determining a pop-up sprinkler head check valve's long term seat tightness

B.1 General

Mount the valve on the apparatus as shown in Figure 1.

B.2 Test procedure

Pressurize the apparatus to a value of 75% of the manufacturer's declared cracking pressure. Close the control valve. Observe the pressure after a run time of 24 hours.

The valve shall remain leak-tight with no sign of weeping at the bleed hole.

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Annex C (Normative)

Test method for the endurance of the pop-up sprinkler head check valves

C.1 General

The test shall be performed with water at ambient laboratory temperature on a pop-up sprinkler head valve assembly. The test shall be able to provide water flow through the valve with a minimum velocity of 3 fps and a downstream pressure equal to 40-50 psi. A data logger is required to identify the cycle at which failure occurred.

C.2 Test procedure

The check valve to be mounted as per commercial practices. Use a cycle timer and solenoid-controlled valve with a demonstrated capability to provide a minimum “on” period of 60 seconds at 40-50 psi followed by a minimum “off” period of 60 seconds at atmospheric pressure. Subject the valve to 2,500 cycles. Remove the sprinkler head check valve and verify that the requirements of Section 5.4 have been meet.

Dismantle the check valve and check by visual inspection for failure of any valve components.

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Annex D (Normative)

Test method for determining a pop-up sprinkler head check valve's resistance to internal pressure

D.1 Replace sprinkler nozzle with a water-tight plug

D.2 After the pop-up assembly has reached its maximum extended position slowly raise the internal pressure to the value specified in paragraph 5.1.1

D.3 Retain the test pressure for 30 minutes

D.4 Release the test pressure and inspect the sprinkler head components for damage

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Annex E (Normative)

Test method for determining a pop-up sprinkler head check valve's pressure loss

E.1 The check valve's pressure loss will be determined by comparing the inlet operating pressure reading of sprinklers with and without check valves at the same flow rate

E.2 Mount a sprinkler without a sprinkler head check valve on a standard pressure tap pipe. Set the flow rate at the midpoint of the manufacturer's design table value and read the pressure

E.3 Mount a sprinkler with a sprinkler head check valve on the pressure tap pipe. Set the same flow rate as used in E.2. Note the pressure reading and compare to the value noted in E.2

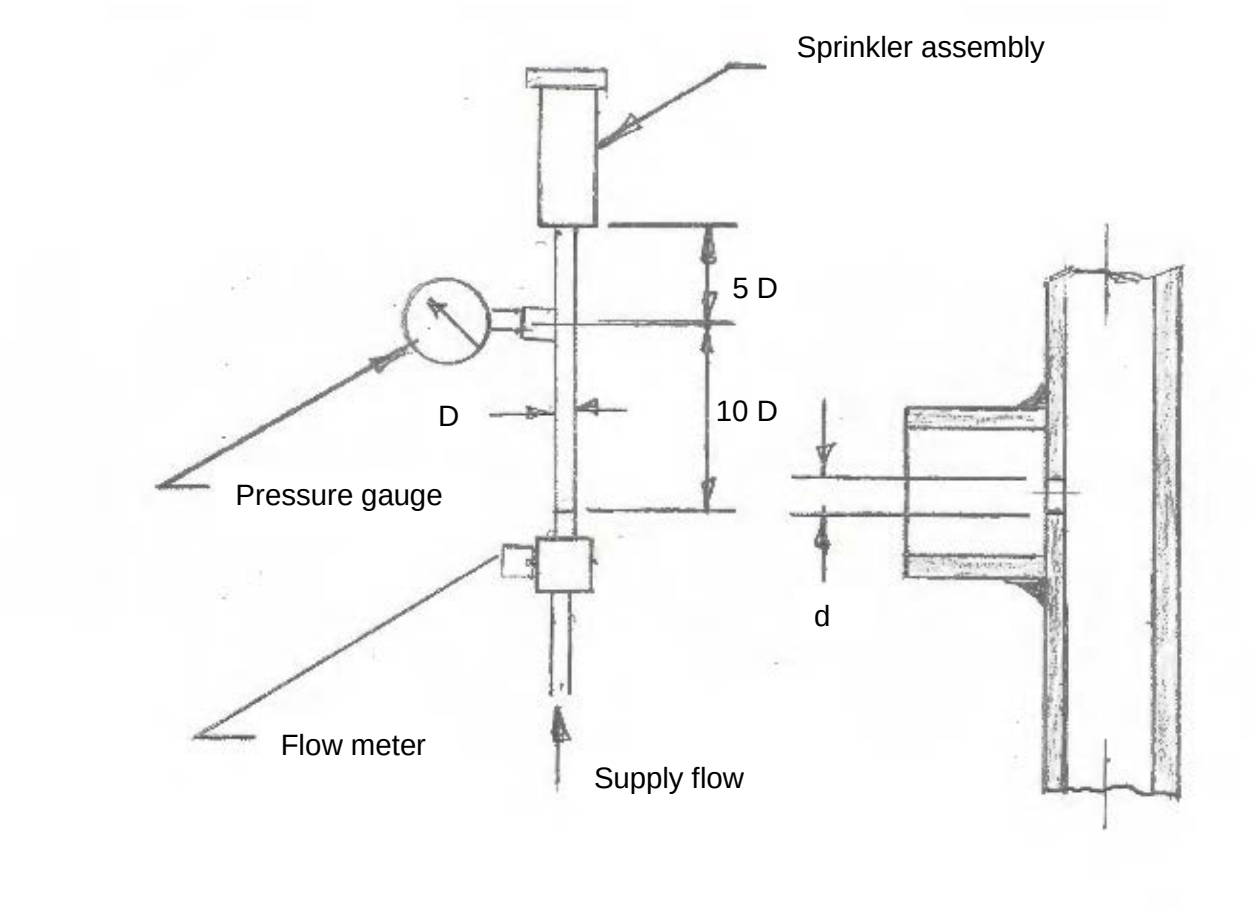

Figure 2. Pressure tap pipe. Note: D refers to pipe internal diameter; d = 1/8 in. diameter