WaterSense Performance Overview: *Spray Sprinkler Bodies*

Equal or superior product performance is a pillar of the WaterSense label. Ensuring performance is vital for maintaining program integrity and consumer confidence in WaterSense labeled products. As part of specification development, the U.S. Environmental Protection Agency (EPA) also evaluates whether high-efficiency products will have other environmental or economic impacts. This includes whether there will be unintended or negative impacts to overall system performance, which may affect user satisfaction and health and safety. This Performance Overview details EPA's process for developing performance test methods and criteria for spray sprinkler bodies. In general, as part of the specification development process, EPA involves many WaterSense stakeholders, including manufacturers, certifying bodies and testing laboratories, standard development organizations, trade organizations, water and energy utilities, and other water efficiency experts and advocates. Each of these stakeholders offers a unique perspective and has dedicated technical expertise and other resources that have contributed to the development of performance criteria used to ensure WaterSense labeled products perform as well or better than standard products on the market.

EPA released the *WaterSense Specification for Spray Sprinkler Bodies* and associated supporting statement on September 21, 2017.[1] The specification applies to spray sprinkler bodies—the exterior case or shell of a sprinkler that connects to the piping system and conveys waters to a nozzle or orifice—with integral pressure regulation.

Summary of Performance Requirements

Table 1 summarizes the performance requirements included in the *WaterSense Specification for Spray Sprinkler Bodies*. Table 1 also describes the purpose of each requirement, the applicable standard the WaterSense specification references, and any specific requirements or deviations from the referenced standard.

[1] More information on EPA's rationale for establishing its efficiency and performance criteria for spray sprinkler bodies can be found in the supporting statement, response to comments, and other background documents found at www.epa.gov/watersense/product-background-materials.

Table 1. Summary of Performance Criteria Included in the *WaterSense Specification for Spray Sprinkler Bodies*

Performance Requirement	Purpose	Referenced Standard (if applicable)	Applies to Conventional Models	Applies to WaterSense Labeled Models
Flow rate	Ensures consistent flow rate at pressures higher than the manufacturer specified regulation pressure for optimal nozzle performance.	ASABE/ICC 802 *Landscape Irrigation Sprinkler and Emitter Standard* with modifications based on validation and performance testing. The maximum flow rate at any tested pressure level shall not exceed a 12 percent deviation from the flow rate at the regulation pressure. The average flow rate across all tested pressures shall not exceed a 10 percent deviation from the flow rate at the regulation pressure.		✓
Outlet pressure	Ensures the pressure across the sprinkler body and subsequently the flow rate do not drop such that it would impact performance.	ASABE/ICC 802 *Landscape Irrigation Sprinkler and Emitter Standard* with modifications based on validation and performance testing. The average outlet pressure at the initial calibration point of the selected samples shall not be less than two-thirds of the regulation pressure.		✓

Development of Performance Requirements

WaterSense began product research on landscape irrigation sprinklers in 2007. The research indicated landscape irrigation sprinklers are often installed at sites where the system pressure is higher than what is recommended for the sprinkler nozzle. This can lead to excessive flow rates, misting, fogging, and uneven coverage. However, performance test methods to address these issues were not available at the time, so WaterSense postponed specification development.

In 2011, WaterSense joined the American Society of Agricultural and Biological Engineers (ASABE)/International Code Council (ICC) committee to develop performance criteria and test methods for landscape irrigation sprinklers and emitters. The committee was comprised of irrigation manufacturers, industry representatives, academia, and water utilities. In 2014, the ASABE/ICC, 802 *Landscape Irrigation Sprinkler and Emitter Standard,* which included requirements for assessing the ability of the spray sprinkler body to regulate pressure, directly addressed the performance attributes of interest. As a result, WaterSense resumed its specification development efforts, initially considering including both high-efficiency nozzles and

pressure-regulating spray sprinkler bodies; however, based on early stakeholder comments and a lack of available data supporting water savings from high-efficiency nozzles, WaterSense decided to move forward with specification development for pressure-regulating sprinkler bodies only and suspended specification development for high-efficiency nozzles until data gaps are filled.

WaterSense worked with three independent laboratories to validate the test method included in ASABE/ICC 802 and determine if it was repeatable and reproducible. Each laboratory tested three models of three separate brands of spray sprinkler bodies with integral pressure regulation, as well as three models of standard, non-pressure regulating spray sprinkler bodies of the same brands. Results from the performance testing demonstrated that the spray sprinkler bodies with integral pressure regulation were able to effectively regulate pressure and flow rate. However, the results were inconsistent among laboratories, indicating the test method needed to be refined. WaterSense subsequently revised the test method to resolve the inconsistencies and added a flow measurement to ensure consistent flow rates regardless of higher inlet pressures, which field studies indicate results in water savings. For additional information on the independent laboratory performance testing and subsequent test method revisions, please review *Landscape Irrigation Sprinklers: WaterSense Specification Update*[2], published in November 2015.

WaterSense then worked with the University of Florida Department of Agricultural and Biological Engineering to conduct a final round of performance testing on eight spray sprinkler body models with integral pressure regulation and three standard spray sprinkler body models using the revised test method. WaterSense used this additional testing to further validate and refine the test protocol, determine the range of product performance, and evaluate potential savings of spray sprinkler bodies with integral pressure regulation when compared to their standard, non-pressure-regulating counterparts. The data from the University of Florida performance testing formed the basis for the efficiency and performance criteria described below. With performance testing complete, EPA published the draft specification in November 2016, held a public comment period and published a final *WaterSense Specification for Spray Sprinkler Bodies* in September 2017.

Spray sprinkler bodies that meet the WaterSense specification requirements have integral pressure regulation, allowing them to control water pressure and provide a constant flow at the nozzle, resulting in a reduction of excess flow out of the sprinkler when water pressure to the system is high. Additionally, they are better able to generate the right amount of water spray and coverage for more uniform distribution of water across the landscape because the sprinkler body maintains a pressure near its optimal operating pressure.

As indicated in Table 8, the specification includes criteria for both flow rate and outlet pressure. The flow rate is tested at 1) the regulation pressure; 2) 10 psi above the regulation pressure; 3) 60 psi; and 4) 70 psi, or the maximum operating pressure specified by the manufacturer, whichever is greater. WaterSense selected these pressures to ensure products perform at intermediate pressures within the operating range of the sprinkler body, as well as at the high end of pressures found in the field. The specification requires the difference between the flow

[2] EPA, 2015. *Landscape Irrigation Sprinklers: WaterSense Specification Update.* November 19, 2015. www.epa.gov/sites/default/files/2017-01/documents/ws-products-spec-irrigation-sprinklers.pdf.

rate at the regulation pressure and the maximum flow rate at any of the tested pressures not to be greater than +/- 12.0 percent. In addition, the specification requires the average flow rate across all tested pressure levels not to exceed +/- 10.0 percent. WaterSense selected these performance levels based on the performance testing conducted at the University of Florida and stakeholder comments[3] received during the draft specification public comment period. The majority of the sprinkler bodies with integral pressure regulation performed at these levels or better (Figure 1).

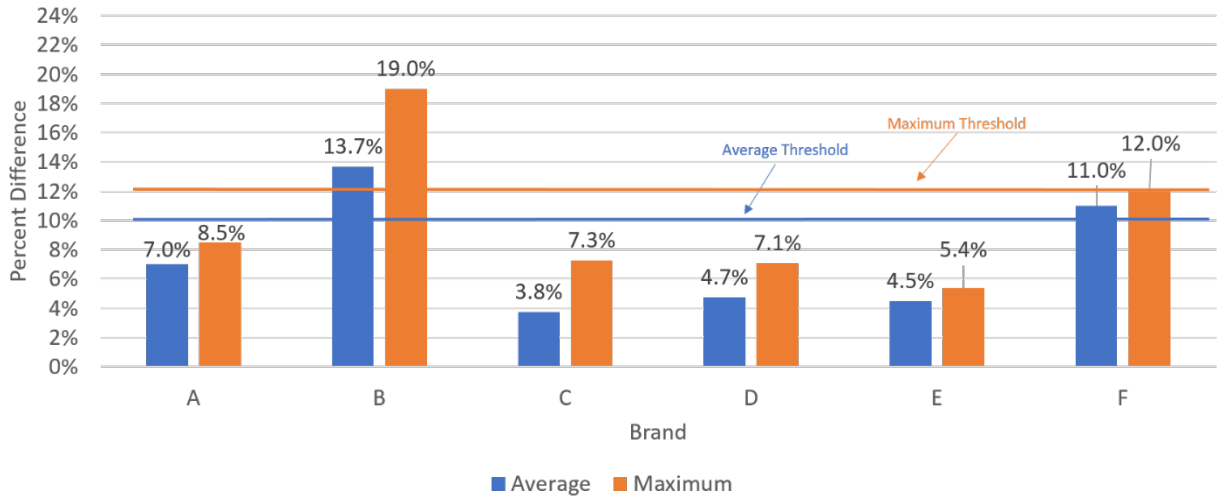

Figure 1. Percent difference between flow rate at tested pressure level(s) and the flow rate at the calibration point[4]

The specification for spray sprinkler bodies also includes an outlet pressure requirement. The average outlet pressure at the initial calibration point must not be less than two-thirds (67 percent) of the regulation pressure. WaterSense selected this threshold to prevent a pressure drop across the sprinkler body significant enough to impact performance. This criterion is stated as a minimum outlet pressure relative to the regulation pressure to ensure that products with higher regulation pressures (e.g., 45 psi) meet minimum pressure requirements generally associated with these products for proper function in the field (e.g., spray sprinkler bodies are commonly used with multi-stream, multi-trajectory nozzles that require a minimum pressure to rotate properly).

[3] EPA, 2017. *Comments on the November 16 WaterSense Draft Specification for Spray Sprinkler Bodies.* June 1, 2017. www.epa.gov/sites/default/files/2017-05/documents/ws-background-ssb-draft-publiccommentcompilation-042117-508.pdf.
[4] EPA, 2017. *WaterSense Specification for Spray Sprinkler Bodies Supporting Statement*. September 21, 2017. www.epa.gov/sites/default/files/2017-09/documents/ws-products-support-statement-ssb.pdf.