

WaterSense Performance Overview: *Showerheads*

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 showerheads. 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 Showerheads](#) and associated supporting statement on March 4, 2010. In 2018, WaterSense completed a minor revision to the specification, releasing Version 1.1.¹

Summary of Performance Requirements

Table 1 summarizes the performance requirements included in the *WaterSense Specification for Showerheads*. Table 1 also describes the purpose of each performance 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 showerheads 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 Showerheads*

Performance Requirement	Purpose	Referenced Standard (if applicable)	Applies to Conventional Models	Applies to WaterSense Labeled Models
Minimum flow rate	Ensures the showerhead will provide for a minimum flow across a range of household water pressures.	ASME A112.18.1/CSA B125.1 <i>Plumbing supply fittings</i> * The minimum flow rate tested at a flowing pressure of 20 psi must not be less than 60 percent of the maximum flow rate. The minimum flow rate tested at a flowing pressure of 45 psi and 80 psi must not be less than 75 percent of the maximum flow rate.		✓
Spray force	Ensures showerhead spray force is sufficient to provide user satisfaction.	ASME A112.18.1/CSA B125.1 <i>Plumbing supply fittings</i> * The minimum spray force shall not be less than 2.0 ounces at a flowing pressure of 20 psi.		✓
Spray coverage	Assesses showerhead spray distribution over the bather to ensure adequate coverage and user satisfaction.	ASME A112.18.1/CSA B125.1 <i>Plumbing supply fittings</i> * The total combined maximum volume of water collected in two center (the 2- and 4-inch) annular rings shall not exceed 75 percent of the total volume of water collected The total combined minimum volume of water collected in the center three (2-, 4-, and 6-inch) annular rings shall not be less than 25 percent of the total volume of water collected.		✓

* These performance requirements were incorporated into ASME A112.18.1/CSA B125.1 for high-efficiency showerheads (i.e., showerheads with flow rates less than 2.0 gallons per minute [gpm]) after its initial inclusion within the *WaterSense Specification for Showerheads*. Because the performance requirement only applies to high-efficiency models, not all showerheads are tested to meet the requirement.

Development of Performance Requirements

EPA collaborated with the American Society of Mechanical Engineers (ASME)/Canadian Standards Association (CSA) Joint Harmonization Task Group on Plumbing Fittings to develop its performance criteria for WaterSense labeled showerheads. This task group was comprised of a wide variety of stakeholders, including showerhead manufacturers, water and energy

utilities, testing laboratories, consultants, and other water efficiency and conservation specialists. Their participation, resources, and expertise enabled WaterSense to evaluate showerhead efficiency and performance and develop meaningful testing protocols that can effectively differentiate showerhead performance.

Prior to the task group's work, there were no universally accepted criteria for measuring showerhead performance. EPA understood potential negative perceptions associated with high-efficiency showerheads, and, therefore, devoted substantial time and resources to collaborate with stakeholders and identify showerhead attributes that are important to users. To support development of performance criteria, WaterSense conducted consumer testing to evaluate user satisfaction related to different standard showerheads and high-efficiency models on the market at the time. The [consumer testing](#) evaluated 16 showerhead models across 37 study participants (from 22 individual households) to determine satisfaction with shower temperature, spray force, spray coverage, and rinsing ability. While the testing sample size was limited, the data from WaterSense's consumer testing was the only available information that assessed showerhead performance factors and user satisfaction. As a result of the consumer testing, WaterSense determined that spray force and spray coverage were the criteria that most influenced user satisfaction. While shower temperature and rinsing ability were also assessed, the study found that user dissatisfaction with these factors correlated with poor force and poor spray coverage. Together, poor force and/or coverage were cited as concerns in more than 75 percent of the unsatisfactory showerheads.

WaterSense, through collaboration with the task group, developed test methods that could be conducted by an independent, third-party laboratory to assess spray force and coverage, discussed in more detail below. WaterSense then used the results of the user satisfaction testing to establish the specific criteria that could differentiate products with which the users were generally dissatisfied. The goal was to identify levels of force and coverage that were unsatisfactory to most users, therefore eliminating those showerheads from earning the WaterSense label.

The task group developed an innovative mechanism to test showerhead spray force in an independent laboratory (Figure 1). The showerhead is mounted in the overhead bathing position, and the spray is directed onto a force balance fixture equipped with a force target on one side that receives the shower spray and counterbalancing weights of 2 ounces on the other side. As the shower spray hits the force target, the force balance fixture measures the rotation angle of the balance at the pivot point of the two sides (the spray and counterbalancing weights). If the shower spray force is greater than the specified 2-ounce minimum, it will move the counterbalancing weights to or beyond the point of balance. The showerhead "passes" the force test if the shower spray exhibits enough force to move the angle of balance.

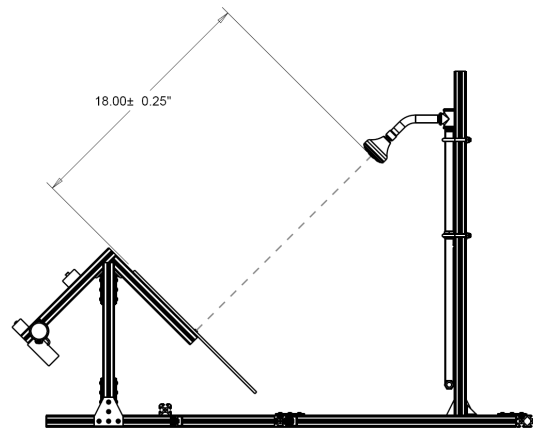


Figure 1. The spray force test protocol apparatus for standard fixed showerheads

EPA and the task group established the 2-ounce force threshold by testing the force of showerheads included in WaterSense’s consumer testing and comparing those values to user satisfaction information from the consumer testing to identify the threshold below which most users reported dissatisfaction. The testing was repeated in multiple laboratories to ensure the results were repeatable and reproducible.

Since the specification was initially published in 2010, the market for showerheads changed. Rain showers, previously a small part of the market and considered a luxury item, have gained popularity. In addition, manufacturers developed new models of rain showers, many of which have flow rates at or below WaterSense’s water efficiency criteria. However, because rain showers are mounted vertically instead of at a 45-degree angle, these products were limited in their ability to earn the WaterSense label under the existing spray force test configuration. Recognizing the market evolution and the desire to provide market choice for efficient products, WaterSense again coordinated with ASME/CSA Joint Harmonization Task Group on Plumbing Fittings to develop a modified test configuration and requirements to provide a path to certification for rain showers that is mathematically equivalent to standard fixed showerheads.² EPA updated the *WaterSense Specification for Showerheads* in 2018 to expand the scope to accommodate this additional subcategory of showerheads.

Similarly, the task group developed an annular ring gauge consisting of a series of concentric rings to assess spray coverage (Figure 2), based on an apparatus included in Australian Standard (AS) 3662 *Performance of showers for bathing*. For the test, the showerhead is mounted directly above the middle of the annual rings and the amount of water collected in each ring (spaced 2 inches apart out to a diameter of 20 inches) is measured to assess the distribution of the shower spray.

² EPA, 2018. *Explanation of Performance Testing Under the WaterSense Specification for Showerheads*. July 26, 2018. www.epa.gov/sites/default/files/2018-07/documents/ws-products-showerheads-performance-testing.pdf.

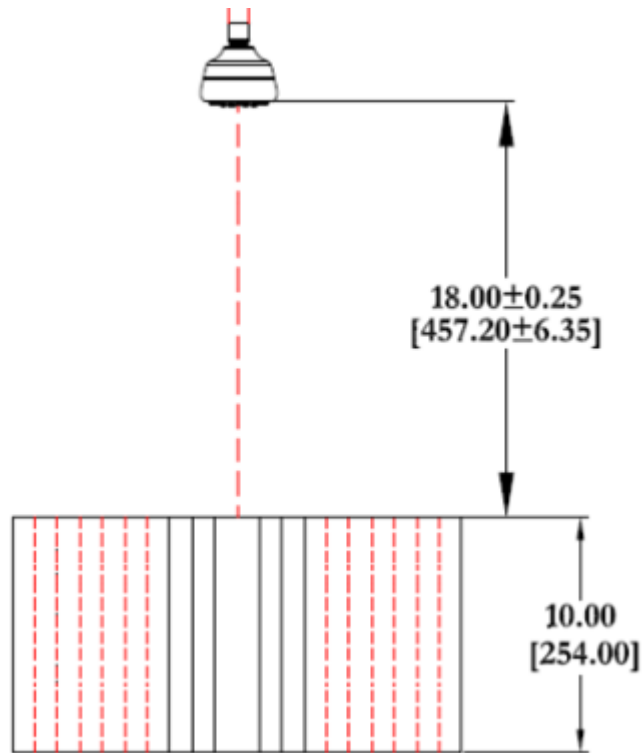


Figure 2a. Cross section of spray coverage apparatus

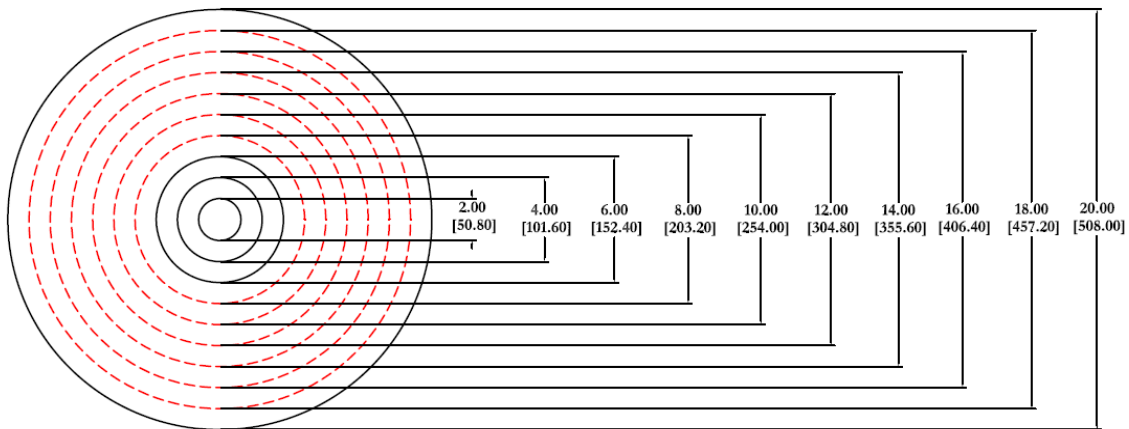


Figure 2b. Top-down view of the annular rings showing the spacing of each concentric ring

WaterSense’s consumer testing data showed general dissatisfaction with showerheads that spray with a hollow spot in the center or that have too much water flowing in the center to form a very narrow beam. Thus, the criteria contained in the specification were crafted to ensure an even distribution of water from the showerhead. Under the *WaterSense Specification for Showerheads*, the total combined volume of water collected in the 2- and 4-inch annular rings cannot exceed 75 percent of the total volume of water collected. Further, the total combined

volume of water collected in the 2-, 4-, and 6-inch annular rings cannot be less than 25 percent of the total volume of water collected. The task group again conducted the spray coverage testing in multiple laboratories to ensure the results were repeatable and reproducible.

The specification also includes minimum flow rate requirements at 80, 45, and 20 psi of pressure (the upper, middle, and lower range of potential household water pressures). Specifically, at 45 and 80 psi, the tested flow rate cannot be less than 75 percent of the showerhead's maximum flow rate value. Likewise, at 20 psi the tested flow rate cannot be less than 60 percent of the showerhead's maximum rated flow rate value. Defining minimum flow rate requirements in this manner ensures that the showerhead is designed to provide consistent flow across a range of household water pressures.

WaterSense's test methods and criteria related to showerhead spray force, spray coverage, and minimum flow rate have since been incorporated into the ASME A112.18.1/CSA B125.1 standard. All high-efficiency showerheads sold in the United States and Canada, whether pursuing the WaterSense label or not, are required to meet these criteria.