BNWAT06: Showers - water efficiency performance tests

Version 2.0

This Briefing Note and referenced information is a public consultation document and will be used to inform Government decisions. The information and analysis form part of the Evidence Base created by Defra's Market Transformation Programme.

1 Summary

This Briefing Note reviews potential approaches to the quantification of water consumption associated with the use of showers. This review has been undertaken in the context of the Market Transformation Programme (MTP), which is seeking to develop a water efficiency rating scheme for water-using appliances and fixtures.

Definition: European Standard EN 13904:2003 defines a shower as a device for ablutionary purposes which allows water to be emitted in the form of jets or water droplets.

2 Background to current standards

The current European Standards for showers are defined on the basis of the water supply system pressure. BS EN 13904:2003 (Low-resistance shower outlets for sanitary tapware) is for showers which are to be used with low-pressure water supply systems. BS EN 1112:1997 (Shower outlets for (PN 10) sanitary tapware) is the equivalent standard for high-pressure water supply systems. Both of these standards include a methodology for calculating the flow rate for showers.

BS EN 1112: 1997 for shower outlets includes a flow rate (hydraulic characteristics) test at a dynamic pressure of 3 bar. The test is comprehensive and defines all the equipment necessary to measure the flow rate at 3 bar without interpretation of the requirements by the test engineer. BS EN 1112 is currently being revised and is undergoing public consultation. This proposed revision includes measurement of the flow rate at both high and low pressure. The revisions of the flow rate test in BS EN 1112 make it suitable for the measurement of flow rate through all types of shower designs likely to be found in the UK market.

BS EN 13904: 2003 includes measurement of flow rates through low-pressure shower heads. Whilst the test is well defined, it is not considered suitable for high-pressure shower outlets and is likely to be superseded by the revision of BS EN 1112 when this is ratified by the EU member states.

BS 6340: Part 4:1984 (Shower Units: Specification for shower heads and related equipment). Whilst other parts of BS 6430 have now been fully or partially replaced, Part 4 of BS 6340 is currently retained in the UK. The standard applies to the shower head or handset only and defines tests to measure the flow rate, the spray form and the spray trajectories.

3 Options for the quantification of water consumption by showers

Showers are the most complex of water fittings for which to set water efficiency criteria. Unlike other water fittings, where efficiency can be measured by a single variable such as flow rate or volume, showers have a number of other variables which must be taken into account. The three main performance criteria which must be considered are:

- Flow rate (hydraulic characteristics).
- Spray pattern.
- Force of spray.

These issues relate to the need for additional performance-related criteria to ensure that a shower with improved water efficiency is also capable of meeting a defined level of customer satisfaction with overall shower performance.

Flow rate is the primary determinant for water consumption associated with shower usage. The flow rate through any design of shower can be measured using the test method described in the latest draft of BS EN 1112 and the shower design can then be rated in terms of flow rate, provided it also meets the minimum requirements for the spray pattern test and the force of spray test. Flow rates through electric showers can also be assessed using the same test method and assessment criteria.

The primary components of this test are summarised below:

- The water temperature should be less than or equal to 30 °C.
- The water supply pressure should be 0.3 ± 0.02 MPa (for a high-pressure supply system) or 0.1 ± 0.005 MPa (for a low-pressure supply system).
- The flow rate should be measured once the flow has stabilised.

Spray pattern is important to ensure that the water emanating from a shower head provides adequate coverage of the shower user. This can be measured using the test method described in BS 6340: Part 4, with some minor modifications to the test method. The tests in this standard are well-defined and practical.

The primary components of this test are summarised below:

- To comply with the standard, the shower head must achieve a minimum flow rate at both 0.1 bar and at the lowest flow rate at which the ‘spray is well formed’.

- The spray form itself is then measured using an annular gauge and the trajectories of the spray are also measured and must conform to the dimensions of an envelope defined in the standard.

Although this standard is essentially for low-resistance shower heads only, the tests are comprehensive and the spray form test could be used on other types of shower head with some minor modifications to the acceptance criteria.

Force of spray – there are no published tests to measure the force of the spray emanating from a shower head. There is a balance to be achieved between the need for a minimum force to ensure customer satisfaction and the 'pain-factor' associated with water droplets hitting the skin. The higher the velocity of the spray, the greater the pressure on the skin.

A number of advances in shower technology in recent years have resulted in modern low-flow showerheads which, through the use of air contained within the water droplets, can give the user a similar experience to showers which use much more water. At present however this cannot be demonstrated through a test.

Work is currently underway in Australia to develop a suitable test and there are studies currently being undertaken into the practicalities of such a test in the UK. The development of this test is vital to ensure that the public are not put off the development of water efficient showers through poor performance and must be pursued before any water efficiency criteria can be set for showers.

4 Proposed test method

The proposed test method for force of spray needs to be developed.

5 Outstanding issues

A range of outstanding issues has been identified in relation to measuring the water consumption associated with shower usage.

Establishing customer satisfaction performance criteria for showers is complex due to the tactile nature of showering. The flow rate and spray pattern can be determined by current test methods. Other criteria that also need to be considered are:

- Temperature gradient (or thermal stability, or temperature uniformity) – this can be affected by droplet size as well as other aspects of the spray pattern. Significant temperature differences between the water leaving the shower outlet and the water falling on the shower tray can necessitate the use of additional hot water to achieve the desired temperature and may also represent a danger associated with scalding. The effectiveness of the water in rinsing soap could also relate to temperature.
- Skin pressure (or velocity of spray, or spray velocity) – this relates to the 'pain-factor' associated with water droplets hitting the skin. Higher velocity sprays will correspond with greater pressure on the skin.

Additional issues arise in relation to the range of shower spray types that are available on the market. For example, products are marketed with terms such as regular, fine, jet, pulsing and massage in reference to spray patterns. The approach to date of the Australian and New Zealand Standard has been to use the 'normal' setting (as defined by the manufacturer) for testing purposes.

Furthermore, shower systems now exist in the market place with multiple shower heads. This raised the question of whether each shower head should be rated individually and then averaged, or whether their ratings should be added together. In the current review of the Australian and New Zealand Standard, consideration is being given to defining the performance (including flow rate) of a multi-head shower system as the sum of its parts.

6 Recommendations

- Shower flow rate should be evaluated using the methodology given in BS EN 1112 (revision in progress).
- Shower spray pattern should be evaluated using the methodology given in BS 6340: Part 4.
- Develop a test procedure to assess overall shower performance in terms of the additional comfort parameters: temperature gradient and skin pressure.
- Review international shower test methodologies, notably those defined in the Australian and New Zealand Standards and consider their applicability to the UK marketplace.
- Evaluate the performance of, and develop a test method for, 'pause' buttons and digital shower settings for temperature and flow patterns.

Related MTP information

Briefing Note BN DW Shower: Shower design and efficiency.

Briefing Note BNWATSH01: Consumer views about showers – summary report.

Changes from version 1.2

Update to current standards

Inclusion of proposals for flow rate and spray pattern assessment

Consultation and further information

Stakeholders are encouraged to review this document and provide suggestions that may improve the quality of information provided, email **info@mtprog.com** quoting the document reference, or call the MTP enquiry line on +44 (0) 845 600 8951.

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