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Sanitetsarmatur – Metod för att bestämma energieffektivitet hos termostatblandare med dusch

Sanitary tapware – Method for determination of energy efficiency of thermostatic mixing valves with shower

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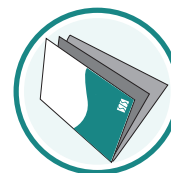
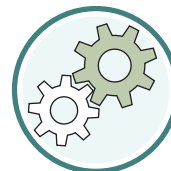
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Introduction

This standard describes a laboratory method for measuring the energy use of a thermostatic mixer supplying a shower head. The quantity of energy used provides a measure of the energy efficiency of the mixer, and is used as a basis for energy classification.

The energy used by sanitary tapware is a function of the water flow and the water temperature. Maximum water flow and maximum water temperature results in maximum energy use.

Sanitary tapware mixers can be provided by their manufacturer with a physical means of preventing the user spontaneously opening the mixer to its maximum flow condition. The flow that can be delivered as a result of the user performing one single manual operation, without bypassing any flow limitation device, is referred to in this standard as the economy flow.

With the same intention, of limiting the tap's energy use, the tap can be designed such that maximum flow and/or maximum temperature can be obtained by a single manual operation, but that the tap returns to a less open position when the user releases his/her grip.

Application of the test method described in this standard enables the energy efficiency of different technical design arrangements of taps to be determined. The purpose of the standard is to encourage development of designs that have high energy efficiency.

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1 Scope

This standard describes a laboratory method for measuring the energy use of a thermostatic mixer, consisting of a shower head, hose, and connections to water supply pipes, setting out the requirement criteria for energy efficiency. The energy efficiency of the mixer provides a basis for energy classification.

The overall objective of the standard is to encourage the development of technical designs that contribute to energy efficiency of sanitary tapware, with particular emphasis on designs that aim to improve energy efficiency rather than simply to limit water flow, i.e. which encourage the user to use less hot water for a given purpose.

2 Normative references

This document refers to the following documents, the use of which is necessary when applying this document. In the case of dated reference documents, only the specified dated edition shall be used. In the case of undated reference documents, the latest edition of the document (including all appendices) shall be used.

SS-EN 1111 Sanitary tapware – Thermostatic mixing valves (PN 10) – General technical specification

3 Terms and definitions

3.1 activity
the use of sanitary tapware in the form of using controls to adjust the water flow, mixer water temperature, supply pressure, supply temperature and rinsing duration. Each individual activity involving adjustment of any given setting is counted as one activity.

3.2 connection fitting to water pipe
mechanical means of connecting sanitary tapware to a water pipe. It can, for example, refer to the means of connection to a copper pipe or a PEX pipe.

3.3 economy flow
the water flow that can be delivered in normal use as a result of opening the tap to its most open position by means of one single manual operation, with no further action

3.4 energy efficiency
the amount of energy used for a number of different activities

3.5 hand action
manual action to open, close or adjust the water flow and temperature from sanitary tapware

Note One hand action is limited to a manual action, actively performed by the user. Performing two manual actions requires the user to perform a second manual action, actively selected and performed, every time that the sanitary tapware item is used.

3.6 maximum flow
the water flow that can be delivered by opening the tap to its most open position by means of one or two hand actions, possibly in conjunction with some other action

3.7

maximum temperature

the water temperature that can be delivered by setting the tap to its highest water temperature position by means of one or two hand actions, possibly in conjunction with some other action

3.8

mixer water temperature

the temperature of mixed water after the outlet of the mixer at/from the shower head

3.9

operating device

a part (e.g. a handle, knob, lever etc.) on the thermostatic mixer intended for operation by the user to open, close or control the flow of water and/or temperature from the sanitary tapware mixer

3.10

shower head

spreader device connected by hose or pipe to the thermostatic mixer for distributing a spray of water or water jet, with or without admixture of air

3.11

supply pressure

the incoming dynamic pressure of hot or cold water

3.12

supply temperature

the incoming hot or cold water temperature

3.13

thermostatic shower mixer

sanitary tapware consisting of a thermostatic mixer, including the associated shower head, shower hose and connection hardware for connection to the water supply, all intended for installation in a shower unit

4 Quantities and units

Q energy use (kWh)

q_m water flow (kg/s)

q_v water flow (m³/s)

t time (s)

T temperature (°C)

C_p thermal capacity of water (J/(kg, °C))

ρ water density (kg/m³)

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5 Testing

5.1 Test rig

5.1.1 General

Install the item to be tested in a test rig connected by insulated pipes to hot and cold water supplies, with each such supply passing through meters/sensors for pressure, temperature and flow.

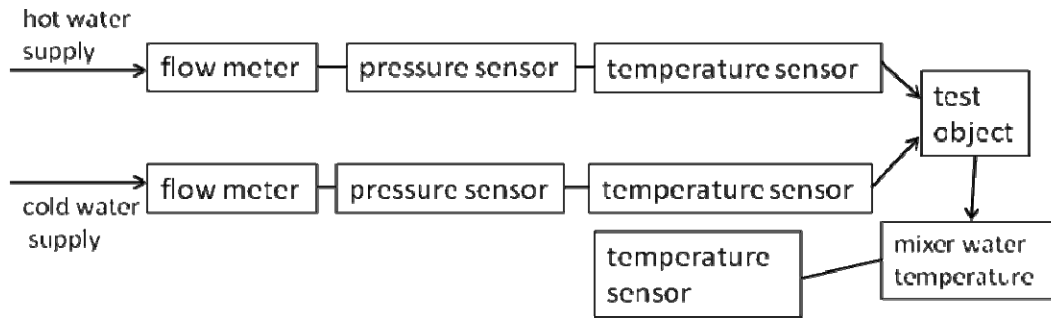


Figure 1– Schematic diagram of test rig with hot and cold water circuits

Each water circuit consists of the following:

- Control devices for temperature, giving control of:
 - a) cold water temperature to $10\text{ °C} \pm 1\text{ °C}$
 - b) hot water temperature to $60\text{ °C} \pm 1\text{ °C}$
- a device for, or means of, maintaining the desired supply pressure of between 0.1 MPa and 0.5 Mpa;
- insulated pipe of a suitable diameter to deliver the required flow of between 0.5 litre/min and 20 litre/min.

The test system shall be so designed that no pressure or temperature drops occur between the meters/sensors and the item under test.

Connect the test item (the thermostatic mixer) to the hot and cold water circuits, and position the hose and shower head so that the outlet from the shower head is $192\text{ cm} \pm 1\text{ cm}$ above floor level.

5.1.2 Water pressure

Measure the supply pressure in each water circuit by means of a pressure gauge/sensor with a measurement accuracy of $\pm 1\%$ of measured value.

5.1.3 Temperature

Measure the water temperature in each water circuit by means of temperature sensors with a measurement accuracy $\pm 0.1\text{ °C}$.

Measure the mixer water temperature in a mixed jet of water, vertically beneath the outlet of the shower head. Make these measurements at distances of $20\text{ cm} \pm 1\text{ cm}$, $60\text{ cm} \pm 1\text{ cm}$, $105\text{ cm} \pm 1\text{ cm}$ and $185\text{ cm} \pm 1\text{ cm}$ between the temperature sensor and the outlet from the shower head. These measurements correspond to equivalent user positions of head, chest and hip height, and foot level, see Figure 2.

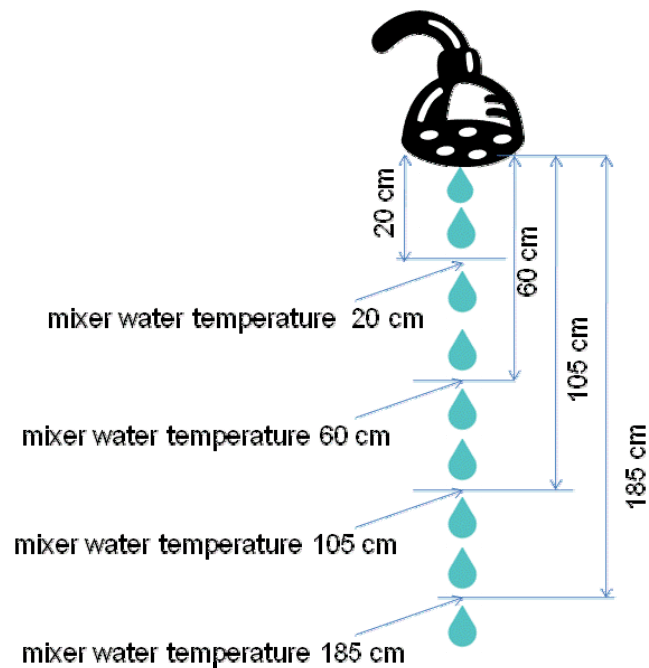


Figure 2 – Schematic diagram of method of measurement of mixer water temperature

Measure the mixer water temperature using a vessel having a sufficiently small outlet hole so that a sufficient quantity of water is collected to permit the temperature sensor to be placed in the water medium rather than in air. However, the outlet hole shall be sufficiently large to ensure that the collected water flows through the vessel. Figure 3 shows the arrangement of a temperature sensor with a measurement accuracy of $\pm 0.1\text{ }^{\circ}\text{C}$ in the collecting vessel.



Figure 3 – An example of the positioning of the temperature sensor in a collecting vessel with a small outlet hole

5.1.4 Water flow

Measure the flow using a flow sensor with an accuracy of $\pm 2\%$ of the measured value.

5.2 Flow control and requirements

Determine the mixer flow as described in SS-EN 1111, Section 10.5, and in accordance with the requirements set out in SS-EN 1111.

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5.3 Temperature drop in the outlet water spray

Measure the temperature drop of the outlet water spray in a shower enclosure in an ambient room temperature between 19 °C and 25 °C, with a flow of 7 litre/min ± 0.1 litre/min, a mixer water temperature of 38 °C ± 0.5 °C at head height (20 cm below the outlet from the shower head), and a supply pressure of 300 kPa ± 20 kPa. Measure the mixer water temperature at chest, hip and foot level (60 cm, 10 cm and 185 cm below the shower head outlet). Determine the temperature drop of the outlet spray/jet as follows:

$$\Delta T_{\text{temp drop}} = 0,45 * (T_{\text{head}} - T_{\text{chest}}) + 0,35 * (T_{\text{head}} - T_{\text{hip}}) + 0,2 * (T_{\text{head}} - T_{\text{foot}})$$

where:

$\Delta T_{\text{temp drop}}$ the temperature drop of the outlet spray/jet;

T_{head} the temperature of the mixer water 20 cm below the shower head outlet;

T_{chest} the temperature of the mixer water 60 cm below the shower head outlet;

T_{hip} the temperature of the mixer water 105 cm below the shower head outlet;

T_{foot} the temperature of the mixer water 185 cm below the shower head outlet.

For energy classes A - D (inclusive), $\Delta T_{\text{temp drop}}$ must be less than 2.5 °C. A thermostatic shower mixer unit having $\Delta T_{\text{temp drop}}$ equal to, or higher than, 2.5 °C cannot be given a higher energy rating than Class E.

5.4 Effective shower water proportion and the spread of the water

Measure the effective shower water proportion by placing a cylindrical vessel having a diameter of 6 cm ± 0.2 cm at a distance of 50 cm ± 0.5 cm from the shower head outlet. Over a period of 30 seconds, with the water flowing at the maximum flow rate with a supply pressure of 300 kPa ± 20 kPa, collect in it the water from the shower head. Repeat the test using a cylindrical vessel having a diameter of 30 cm ± 0.5 cm, and then again with a cylindrical vessel having a diameter of 80 cm ± 0.5 cm. Calculate the effective shower water proportion and the spread of the water from:

$$\eta_{\text{water}} = \frac{V_{30\text{cm}}}{V_{80\text{cm}}}$$

and

$$\eta_{\text{spreading}} = \frac{V_{6\text{cm}}}{V_{30\text{cm}}}$$

where

η_{water} the effective shower water proportion

$\eta_{\text{spreading}}$ the amount of the water collected by the 6 cm cylinder in proportion to that collected by the 30 cm cylinder

$V_{6\text{cm}}$ volume of water collected in the 6 cm diameter cylinder

$V_{30\text{cm}}$ volume of water collected in the 30 cm diameter cylinder

$V_{80\text{cm}}$ volume of water collected in the 80 cm diameter cylinder

For energy classes A or B, the water spread ratio, $\eta_{\text{spreading}}$, must be less than 0.7. A thermostatic shower mixer having a water spread ratio equal to or higher than 0.7 cannot be given a better energy class rating than Class C.

5.5 Rinse performance

5.5.1 General

Determine the efficiency of the thermostatic shower mixer by measuring the rinsing time of a test cloth.

5.5.2 Test equipment

Figure 4 shows a schematic arrangement of the test equipment, which consists of:

- An unused yellow test cloth of size 15 cm x 15 cm. See Annex A for requirements applicable to the test cloth;
- Funnel (truncated cone), of height 40 cm ± 0.5 cm, with top diameter 30 cm ± 1 cm, and bottom diameter 4 cm ± 0.5 cm. Mount the funnel vertically;
- Wire mesh, horizontally positioned 2-4 cm below the upper end of the cone (in order to avoid splashes outside the cone). The mesh to be so shaped that it does not flex under the weight of the support sheet, test cloth and water stream;
- Upper plate (support sheet), of carbonate plastic, size 15 cm x 15 cm, placed on the horizontal wire mesh so that the water stream meets the centre of the test cloth. The distance between the centre of the test cloth and the outlet from the tap shall be 20 cm ± 0.5 cm;
- Lower sheet (inspection sheet), of carbonate plastic, size 25 cm x 25 cm, colour white (colour code S 1002-Y, in accordance with [1] NCS colour atlas (SS 19102)). Position the sheet underneath the lower end of the funnel, at an angle of 30° ± 1° to the horizontal. The distance between the centre of the funnel outlet and the inspection sheet shall be 5 cm ± 0.5 cm;
- Arrange the lighting conditions so that the illuminance in accordance with [2] (SS-EN 12464-1) at the inspection sheet is not less than 800 lux, and so that that the colour reproduction index in accordance with [3] (SS-EN 12665) has an RA value higher than 95;
- Red food colouring. See Annex A for requirements applicable to the food colouring.

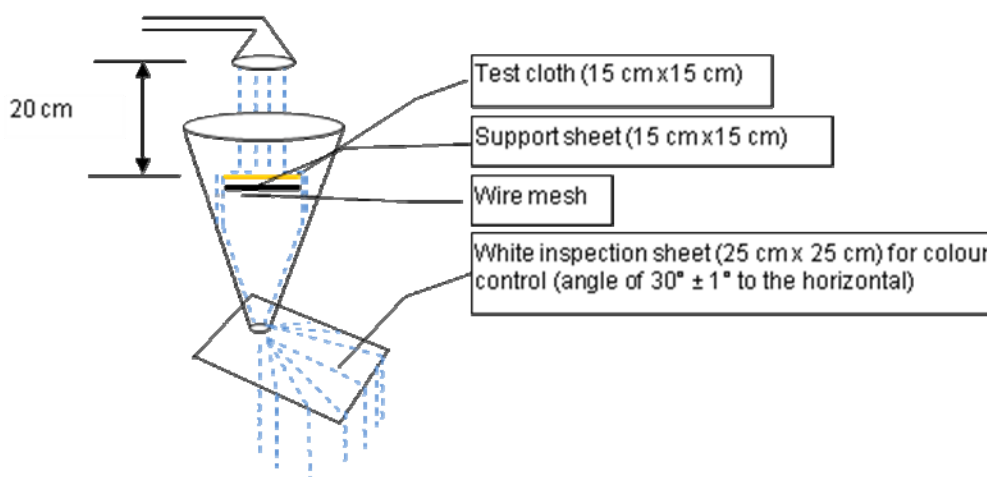


Figure 4 – Test equipment