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Thermostatic mixing valves for use in care establishments

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- Association of Manufacturers of Domestic Unvented Supply Systems Equipment (MODUSSE)
- British Bathroom Council
- British Non-ferrous Metals Federation
- British Plastics Federation
- Chartered Institution of Water and Environmental Management
- Department of the Environment, Transport and the Regions — Water and Land Directorate
- Department of the Environment, Transport and the Regions
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- Institute of Plumbing
- Local Authority Organizations
- Water UK

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Foreword

This British Standard has been prepared by Technical Committee B/504 and is developed to complement existing mixing valve standards where a particular risk to the user may exist.

CAUTION Where commissioning of the thermostatic mixing valve is carried out at inlet supply conditions not representative of usual (day-to-day) operating conditions, the resulting settings may lead to the valve supplying water at elevated temperatures (see annex A).

Annexes B, C, D and H are normative. Annexes A, E, F and G are informative.

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Summary of pages

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Introduction

It has been recognized that users of domestic hot water for ablutionary purposes in care establishments are often at risk of injury by scalding. For some time this risk has been attenuated by the use of thermostatic mixing valves (TMVs). However, the existing standards available for such products are more applicable to normal domestic use. In order to assure the performance of thermostatic mixing valves providing a significantly reduced risk of emitting water at an unsafe temperature this standard has been prepared.

An assessment of any perceived risk should be carried out, for example, in accordance with NHS Estates' Health Guidance Note, *Safe hot water and surface temperatures* [1].

Application for washbasin use is considered for those situations where the risk assessment shows that a greater level of protection is necessary.

Advice on avoidance of multiple outlets, where the dead leg may aggravate the risk of bacterial growth, is given in: NHS Estates' *Health Technical Memorandum* No. 2027 [2].

Only thermostatic mixing valves with no user accessible adjustment of the mixed water temperature should be used for applications in which two or more outlets may discharge simultaneously when operated by two or more users at the same time. Thermostatic mixing valves with user accessible adjustment of the mixed water temperature may be used with two or more outlets which do not discharge simultaneously, (e.g. they are supplied through a diverter) provided that the mixed water temperature adjustment is appropriate to each application.

The severity of the test requirements included in this standard are based on the assumed worst case supply conditions which can exist in healthcare premises and also the need to provide the extra protection needed by patients in such premises, some of whom may be disadvantaged by virtue of their age or infirmity.

It is recognized that outside the field of healthcare premises, there may exist better supply conditions together with a more robust profile of users which could facilitate the use of TMVs of a lesser specification, e.g. BS EN 1111 and BS EN 1287. However, the use of any TMV should be as a result of a risk assessment carried out for the particular installation.

1 Scope

This British Standard specifies performance and material requirements and test methods for three distinct types of thermostatic mixing valves, as defined in clause 5, of nominal size, up to and including DN25, for use in care establishments.

This standard applies to thermostatic mixing valves installed for ablutionary purposes in care establishments for which the hot and cold water supplies are within the limits given in Table 1 for each operating pressure range with the mixed water temperature set in accordance with Table 2.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 6920-1, *Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water: Part 1 — Specification.*

BS 6920-2, *Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of water: Part 2 — Methods of test.*

BS 6920-3, *Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water: Part 3 — High temperature tests.*

3 Terms and definitions

For the purposes of this British Standard the following terms and definitions apply.

3.1

thermostatic mixing valve (TMV)

valve with one or more outlets which mixes hot and cold water and automatically controls the temperature of the mixed water to a user selected or pre-set value

NOTE If provision for controlling the flow rate between no flow and maximum flow is included this may be by means of a different motion of the temperature control or by a separate control.



Table 1 — Conditions for normal use

Operating conditions	High pressure	Low pressure
Maximum static pressure, bar	10	10
Flow pressure, hot and cold, bar	1 to 5	0.2 to 1
Hot supply temperature, °C	52 to 65	52 to 65
Cold supply temperature, °C	5 to 20	5 to 20

Table 2 — Mixed water temperature

Application	Abbreviated designation ^a	Maximum mixed water temperature ^b °C
Bidet	-HP-B, BE; -LP-B, BE	38
Shower	-HP-S, SE; -LP-S, SE	41
Washbasin	-HP-W, WE; -LP-W, WE	41
Bath (44 °C fill)	-HP-T44; -LP-T44	44
Bath (46 °C fill)	-HP-T46; -LP-T46	46
NOTE 1 For washbasins, washing under running water is assumed.		
NOTE 2 Bath fill temperatures of more than 44 °C should only be available when the bather is always under the supervision of a competent person (e.g. nurse or care assistant).		
NOTE 3 A thermostatic mixing valve having multiple designations (see clause 10), i.e. capable of satisfying the requirements of this specification for more than one application, should be reset on site to suit its other designations.		
^a See clause 10.		
^b This is the temperature at the point of discharge.		

3.2
care establishment

hospital, nursing home, or residential care home etc. where elderly patients and mentally handicapped persons etc. are cared for

NOTE Users of TMVs in such establishments (e.g. patients, residents etc.), by virtue of their physical or mental condition, are deemed to be at greater risk of injury in their use of domestic hot water than would be the case for normally able persons in their own dwelling.

3.3
user adjustable

having a control accessible by the user which enables the temperature to be adjusted between a pre-determined maximum and some lower value

NOTE The pre-determined maximum is set on commissioning of the installation.

3.4
pre-set

having no user accessible adjustment and having the mixed water temperature set to a fixed value

NOTE The fixed value is set on commissioning of the installation.

4 Materials in contact with water

Non-metallic materials shall conform to BS 6920-1, -2 and -3.

5 Types

Valves shall conform to type a), b) or c) as follows:

- a) having both flow control and user adjustment of mixed water temperature;
- b) having flow control and pre-set mixed water temperature;
- c) without flow control and with pre-set temperature.

Type c) shall be provided with integral backflow prevention devices incorporated in the valve inlets or supplied with the valve for connection to the inlets on installation.

NOTE Types a) and b) may be presented either with or without an integral or associated backflow prevention device.

Where a thermostatic mixing valve incorporates removable devices (e.g. flow rate regulators), in order to permit on-site designation selection, the valve shall be supplied with the devices fitted.

6 Description of test sequence

For all the tests described in clauses 7, 8 and 9 the thermostatic mixing valve shall be fitted with the anti-backflow devices (e.g. check valves etc.) required in use. These shall be integral with the mixing valve, supplied with it, or specified by the manufacturer. If not fitted to the test samples these devices shall be fitted in the connected pipe work as close as possible to the mixing valve.

Four test specimens of each type of thermostatic mixing valve shall be tested which shall be denoted by number. The test specimens shall be tested in accordance with the sequence and clause numbers shown in Figure 1. The performance tests in clause 9 shall be carried out on test specimens 1 and 4 for the applicable designation in each operating pressure range having the highest mixed water temperature setting of those designations with the lowest designated flow rate. Test specimen 3 shall be tested for all applicable designations.

7 Leaktightness

7.1 Mixing valves of type a) or b) with independent flow control

7.1.1 Leaktightness upstream of the obturator, and of the obturator

7.1.1.1 Requirement

When the selected test specimen is tested as described in 7.1.1.2 there shall be no leakage or seepage through the walls of the valve upstream of the obturator and there shall be no leakage at the obturator. The valve shall subsequently meet the requirements of 7.1.2.

7.1.1.2 Procedure

With the outlet(s) open and the on/off (flow) control closed apply a static water pressure of (16 ± 0.5) bar simultaneously to both inlets of the mixing valve for (60 ± 5) s while the temperature control is adjusted over its full range.

7.1.1.3 Expression of results

Record any leakage or seepage through the walls upstream of the obturator.

Record any leakage past the obturator.

7.1.2 Leaktightness: cross flow between inlets

7.1.2.1 Requirement

When the specimen as tested in 7.1.1 is tested as described in 7.1.2.2 there shall be no leakage or seepage at the end of the unconnected inlet or at the outlet. The test specimen shall subsequently meet the requirements of 7.1.3.

7.1.2.2 Procedure

7.1.2.2.1 With the outlet(s) open, the cold water inlet open and not connected, and the on/off (flow) control closed apply a static water pressure of (4 ± 0.2) bar to the hot water inlet for (60 ± 5) s while the temperature control is adjusted over its full range.

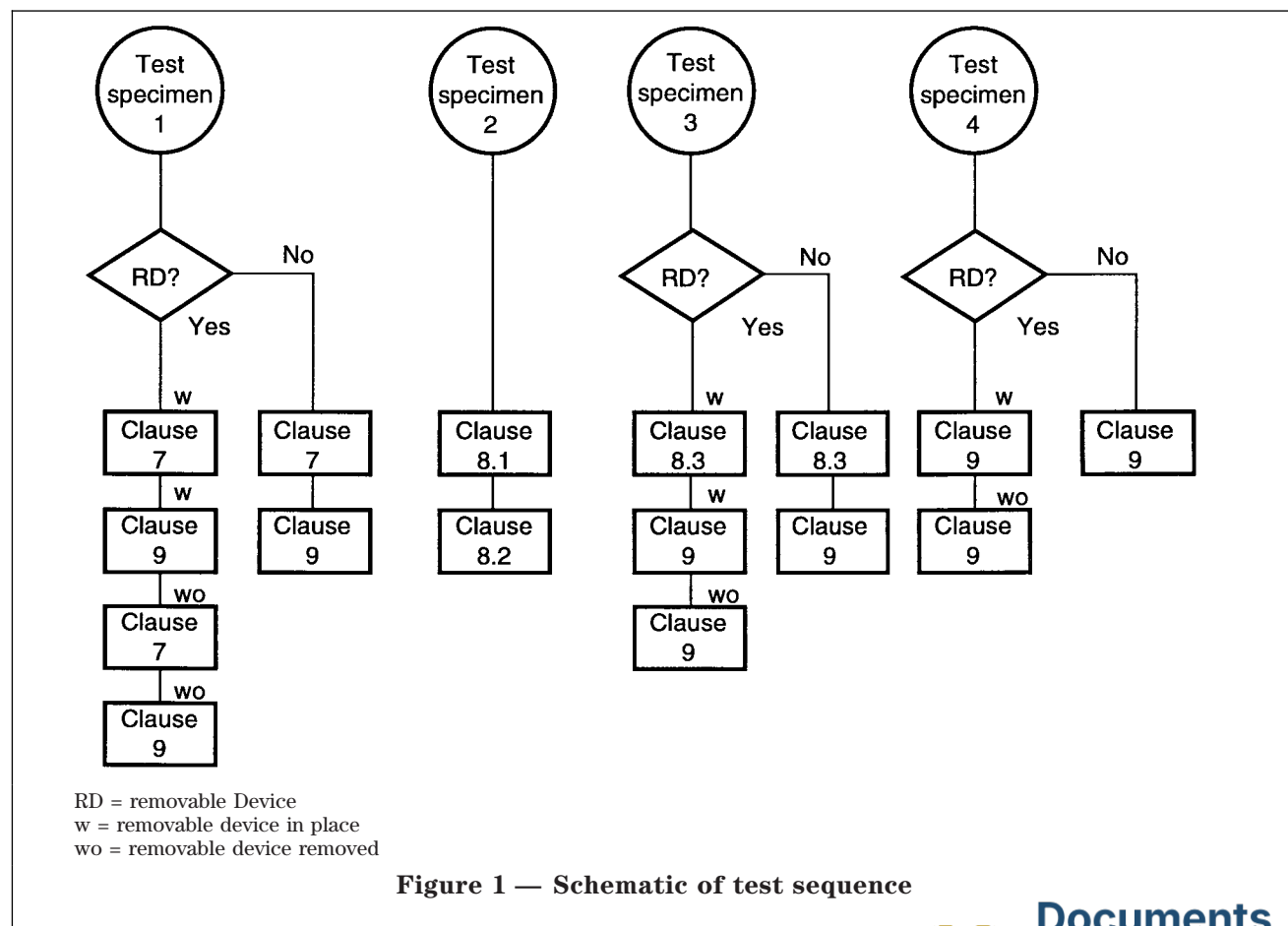


Figure 1 — Schematic of test sequence

7.1.2.2.2 Repeat the test with the cold water inlet pressurized and the hot water inlet open and not connected.

7.1.2.3 Expression of results

Record any leakage or seepage at either the outlet or the unconnected inlet.

7.1.3 Leak tightness downstream of the obturator

7.1.3.1 Requirement

When the specimen as tested in 7.1.2 is tested as described in 7.1.3.2 there shall be no leakage or seepage. The test specimen shall subsequently meet the requirements of 7.4 or 7.5 if appropriate.

7.1.3.2 Procedure

7.1.3.2.1 With the outlet(s) plugged and the on/off (flow) control open apply a static water pressure of (4 ± 0.2) bar simultaneously to both inlets of the mixing valve for (60 ± 5) s while the temperature control is adjusted over its full range.

7.1.3.2.2 Repeat the procedure with a static water pressure of (0.2 ± 0.05) bar.

7.1.3.3 Expression of results

Record any leakage or seepage.

7.2 Mixing valves of type a) with single sequential control

7.2.1 Leaktightness upstream of the obturator, and of the obturator

7.2.1.1 Requirement

When the selected test specimen is tested as described in 7.2.1.2 there shall be no leakage or seepage through the walls of the valve upstream of the obturator and there shall be no leakage at the obturator. The valve shall subsequently meet the requirements of 7.2.2.

7.2.1.2 Procedure

With the outlet(s) open and the control in the flow closed position apply a static water pressure of (16 ± 0.5) bar simultaneously to both inlets of the mixing valve for (60 ± 5) s.

7.2.1.3 Expression of results

Record any leakage or seepage through the walls upstream of the obturator.

Record any leakage past the obturator.

7.2.2 Leaktightness: cross flow between inlets

7.2.2.1 Requirement

When the specimen as tested in 7.2.1 is tested as described in 7.2.2.2 there shall be no leakage or seepage at the end of the unconnected inlet not at the outlet. The test specimen shall subsequently meet the requirements of 7.2.3.

7.2.2.2 Procedure

7.2.2.2.1 With the outlet(s) open, the cold water inlet open and not connected and the control in the flow closed position apply a static water pressure of (4 ± 0.2) bar to the hot water inlet for (60 ± 5) s.

7.2.2.2.2 Repeat the test with the cold water inlet pressurized and the hot water inlet open and not connected.

7.2.2.3 Expression of results

Record any leakage or seepage at either the outlet or the unconnected inlet.

7.2.3 Leaktightness downstream of the obturator

7.2.3.1 Requirement

When the specimen as tested in 7.2.2 is tested as described in 7.2.3.2 there shall be no leakage or seepage. The test specimen shall subsequently meet the requirements of 7.4 or 7.5 as appropriate.

7.2.3.2 Procedure

7.2.3.2.1 With the outlet(s) plugged and the control in an open position apply a static water pressure of (4 ± 0.2) bar simultaneously to both inlets of the mixing valve for (60 ± 5) s while the control is adjusted over the temperature adjustment range.

7.2.3.2.2 Repeat the procedure with a static water pressure of (0.2 ± 0.05) bar.

7.2.3.3 Expression of results

Record any leakage or seepage.

7.3 Mixing valves of type c)

7.3.1 Leaktightness of the mixing valve

7.3.1.1 Requirement

When the selected test specimen is tested as described in 7.3.1.2 there shall be no leakage or seepage. The valve shall subsequently meet the requirements of 7.3.2.

7.3.1.2 Procedure

With the outlet(s) plugged apply a static water pressure of (16 ± 0.5) bar simultaneously to both inlets of the mixing valve for (60 ± 5) s while the temperature control is adjusted over its full range.

7.3.1.3 Expression of results

Record any leakage or seepage.

7.3.2 Leaktightness: cross flow between inlets

NOTE For this test, backflow prevention devices supplied with the valve for connection to the inlet need to be connected.

7.3.2.1 Requirement

When the specimen as tested in 7.3.1 is tested as described in 7.3.2.2 there shall be no leakage or seepage at the end of the unconnected inlet.

7.3.2.2 Procedure

7.3.2.2.1 With the outlet(s) plugged and the cold water inlet open and not connected apply a static water pressure of (4 ± 0.2) bar to the hot water inlet for (60 ± 5) s while the temperature control is adjusted over its full range.



7.3.2.2.2 Repeat the test with the cold water inlet pressurized and the hot water inlet open and not connected.

7.3.2.3 Expression of results

Record any leakage or seepage at the unconnected inlet.

7.4 Manual diverters

7.4.1 Requirement

When the specimen as tested in 7.1 or 7.2 as appropriate is tested as described in 7.4.2, there shall be no leakage at the unselected (open) outlets.

7.4.2 Procedure

7.4.2.1 With one outlet plugged, and the plugged outlet selected, apply the static water pressure appropriate to the designation given in Table 3 for (60 ± 5) s.

Table 3 — Test pressures for manual diverters

Abbreviated designation	Static water pressure bar
All-LP-	2 ± 0.1
All-HP-	4 ± 0.2

7.4.2.2 Repeat the test with a static water pressure of (0.2 ± 0.05) bar.

7.4.2.3 Repeat the procedure 7.4.2.1 and 7.4.2.2 for each outlet.

7.4.3 Expression of results

Record any leakage at the unselected (open) outlet(s).

7.5 Diverters with automatic return

7.5.1 Requirement

When the specimen as tested in 7.1 or 7.2 as appropriate is tested as described in 7.5.2 the diverter shall not dislodge and shall return to the flow to bath position, and there shall be no leakage at the shower or bath outlet point.

7.5.2 Procedure

7.5.2.1 With the diverter in the flow to bath position apply a flow pressure equal to the initial flow pressure appropriate to the designation in accordance with Table 4 for (60 ± 5) s. Check for leakage at the shower outlet.

7.5.2.2 Fit the hydraulic resistance appropriate to the designation in accordance with Table 4 to the connection for the shower outlet.

7.5.2.3 Maintaining the flow pressure at the initial value for (60 ± 5) s, put the diverter in the flow to shower mode. Observe the bath outlet and check for leakage.

7.5.2.4 With the diverter still in the flow to shower position, reduce the flow pressure to the reduced flow pressure appropriate to the designation in accordance with Table 4. Check that the diverter is not dislodged. Maintain this flow pressure for (60 ± 5) s and check for leakage at the bath outlet.

7.5.2.5 Turn off the water supply to the diverter. Check that the diverter returns to the flow to bath position.

7.5.2.6 Disconnect the hydraulic resistance and re-apply the reduced flow pressure. Check for leakage at the shower outlet.

7.5.3 Expression of results

Record any leakage at points 7.5.2.1, 7.5.2.3, 7.5.2.4 and 7.5.2.6 of procedure.

Record dislodgement of diverter in 7.5.2.4 and position of diverter in 7.5.2.5.

Table 4 — Test pressures and flow resistances for diverters with automatic return

Abbreviated designation	Initial flow pressure bar	Reduced flow pressure bar	Hydraulic resistance
All-LP-	0.8 ± 0.04	0.2 ± 0.01	Conforming to Figure 2 and calibrated to a flow rate of 9 L/min at a flow pressure of 0.2 bar referenced to the datum shown
All-HP-	4 ± 0.2	0.5 ± 0.05	A flow resistance calibrated to a flow rate of 15 L/min at a flow pressure of 0.2 bar