BRITISH STANDARD

BS EN 1286:1999

Sanitary tapware — Low pressure mechanical mixing valves — General technical specification

The European Standard EN 1286:1999 has the status of a British Standard

ICS 91.140.70

National foreword

This British Standard is the English language version of EN 1286:1999. It supersedes BS 1415-1:1976 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee B/504, Water supply, to Subcommittee B/504/8, Terminal fittings, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Summary of pages

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EUROPEAN STANDARD
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EN 1286

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English version

Sanitary tapware — Low pressure mechanical mixing valves — General technical specification

Robinetterie sanitaire — Mitigeurs mécaniques basse pression — Spécifications techniques générales

Sanitärarmaturen — Mechanisch einstellbare Mischer für den Niederdruckbereich — Allgemeine technische Spezifikation

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CEN

European Committee for Standardization
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Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 1286:1999 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 164, Water supply, the Secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 1999, and conflicting national standards shall be withdrawn at the latest by October 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

Introduction

In respect of potential adverse effects on the quality of water intended for human consumption, caused by the product covered by this standard:

1) This standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA.

2) It should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

1 Scope

This European Standard specifies requirements for low hydraulic resistance mechanical mixing valves suitable for use in low pressure water supply systems as described in informative annex C.

This European Standard specifies:

— the dimensional, leaktightness, mechanical and hydraulic performance, mechanical endurance characteristics with which low pressure mechanical mixing valves shall comply;

— the procedure for testing these characteristics.

It is applicable:

— to low pressure mechanical mixing valves, intended for use on sanitary appliances in washrooms (toilets, bathrooms etc.) and in kitchens;

— to low pressure mechanical mixing valves used under the following pressure and temperature conditions given in Table 1.

NOTE Mechanical mixing valves for use at pressures in excess than those in Table 1 are covered by EN 817.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 31, *Pedestal wash basins — Connecting dimensions.*

EN 32, *Wall hung wash basins — Connecting dimensions.*

EN 35, *Pedestal bidets over rim supply only — Connecting dimensions.*

EN 36, *Wall hung bidets over rim supply only — Connecting dimensions.*

EN 111, *Wall hung rinse basins — Connecting dimensions.*

EN 232, *Baths — Connecting dimensions.*

EN 246, *Sanitary tapware — General specifications for flow rate regulators.*

EN 248, *Sanitary taps — General technical specifications for electrodeposited nickel chrome coatings.*

EN 695, *Kitchen sinks — Connecting dimensions.*

EN 817, *Sanitary tapware — Mechanical mixers (PN 10) — General technical specifications.*

EN 1254-2, *Copper and copper alloys — Plumbing fittings — Part 2: Fittings with compression ends for use with copper tubes.*

prEN 1717, *Protection against pollution of potable water in drinking water installations and general requirements of devices to prevent pollution by backflow.*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation.*

ISO 5167-1:1991, *Measurement of fluid flow by means of pressure differential devices — Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full.*

3 Definition

For the purposes of this standard, the following definition applies.

3.1

mechanical mixing valve

valve which by means of a control device mixes hot and cold water between the "all cold water" position and the "all hot water" position and adjusts the flow rate of the mixture obtained between the "no flow" and "maximum flow" positions, either using the same control device or another separate control device

Table 1 — Conditions for the use of low pressure mechanical mixing valves

	Limits of use	Recommended limits for correct operation
Dynamic pressure	0,01 to 0,1 MPa (0,1 to 1 bar)	0,02 MPa $\leq P \leq$ 0,1 MPa (0,2 bar $\leq P \leq$ 1,0 bar)
Hot water temperature	$T \leq$ 90 °C	55 $\leq T \leq$ 65 °C
Cold water temperature	$T \leq$ 25 °C	$T \leq$ 25 °C
Mechanical strength [1]	static pressure = 1 MPa (10 bar)	

For low pressure mechanical mixing valves complying with this table there are no acoustical requirements.

Low pressure mechanical mixing valves complying with this standard may also be used with inlet supply pressures in the range from 0,1 MPa to 0,2 MPa (1,0 bar to 2,0 bar) on condition that acoustical performance is not a requirement of the installation.

[1] Low pressure mechanical mixing valves are designed to provide sufficient mechanical strength for operation at 1 MPa (10 bar) static pressure.

4 Classification

There are two types of low pressure mechanical mixing valves:

4.1 Single control mechanical mixing valves

Mechanical mixing valves with a single control device for adjusting flow rate and temperature.

4.2 Other mechanical mixing valves

Mechanical mixing valves with separate control devices for adjusting flow rate and temperature.

5 Designation

A low pressure mechanical mixing valve is designated by:

— its type (see clause **4**);

— its nominal size (1/2 or 3/4) (see Table 4), with or without diverter (see Table 2);

— type of body (see Table 2);

— type of nozzle (see Table 2);

— sanitary appliance on which it is to be used (see Table 2);

— method of mounting (see Table 2);

— its flow rate series (see Table 12);

— the letters LP (low pressure);

— reference to this standard (EN 1286).

In the case of a mechanical bath/shower mixer, the flow rate shall be designated by both flow rate series. The first for the bath outlet, the second for the shower outlet.

EXAMPLE

Single control mechanical mixing valves 3/4, with diverter, visible body and fixed nozzle outlet, for bath/shower, for horizontal mounting, series 250, LP EN 1286.

Table 2 — Designation

Diverter	with or without diverter
Type of body	Two hole, single hole, visible or concealed
Type of nozzle	fixed or moveable nozzle outlet, no nozzle outlet
Intended use	basin, bidet, sink, bath or shower
Mounting method	horizontal or vertical surfaces

6 Marking — Identification

6.1 Marking

Mechanical mixing valves complying with this standard shall be marked permanently and legibly with:

— the mark or name of the manufacturer;

— the letters L.P.

6.2 Identification

The temperature control device for the mechanical mixer shall be identified:

— for cold water by the colour blue;

— for hot water by the colour red.

The identification of cold water shall be on the right and the hot water on the left.

7 Materials

7.1 Chemical and hygienic characteristics

All materials in contact with water intended for human consumption shall present no health risk up to a temperature of 90 °C. They shall not cause any deterioration in water intended for human consumption, with regard to food quality, appearance, odour or taste.

Within the recommended limit given in clause **1** for correct operation, the materials shall not be subject to any deterioration which might compromise the operation of the mechanical mixing valve. Pressurized parts shall withstand the limits of use set in Table 1. Materials with inadequate corrosion resistance shall be given additional protection.

7.2 Exposed surface condition and quality of coating

Visible chromium plated surface and Ni-Cr coatings shall comply with the requirements of EN 248.

8 Dimensional characteristics

8.1 General comment on drawing

The design and construction of components without defined dimensions permits various design solutions to be adopted by the manufacturer.

Special cases are covered in **8.5**.

8.2 Low pressure mechanical mixing valves mounted on horizontal surfaces

The standardized dimensions of mechanical mixing valves:

— firstly, guarantee their mounting and interchangeability on sanitary appliances complying with EN 31, EN 32, EN 35, EN 36, EN 111, EN 232, EN 695;

— secondly, give the various options for connection with the water supply.

8.2.1 ***Single-hole mechanical mixing valves — visible body*** (see Table 3)

8.2.1.1 *Without spray attachment* [see Figure 1a)]

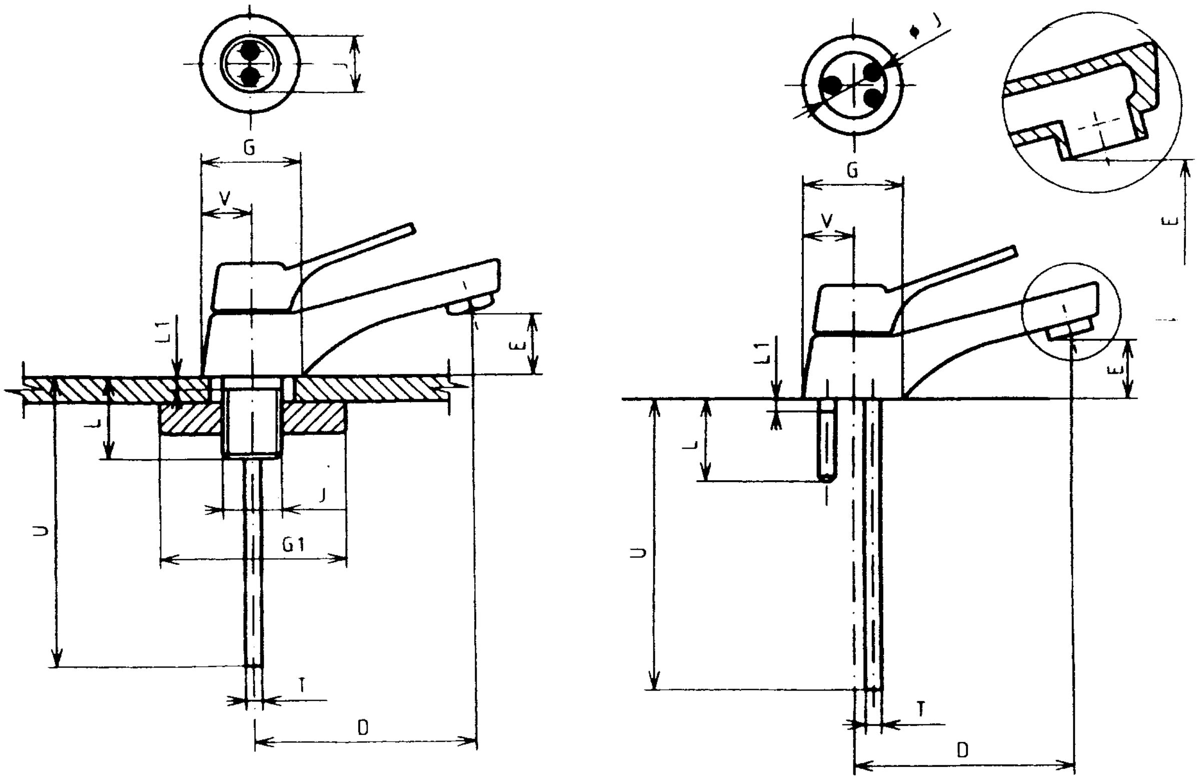


Figure 1a) — Single-hole mechanical mixing valve without spray attachment

8.2.1.2 *With spray attachment* [see Figures 1b) and 1c)]

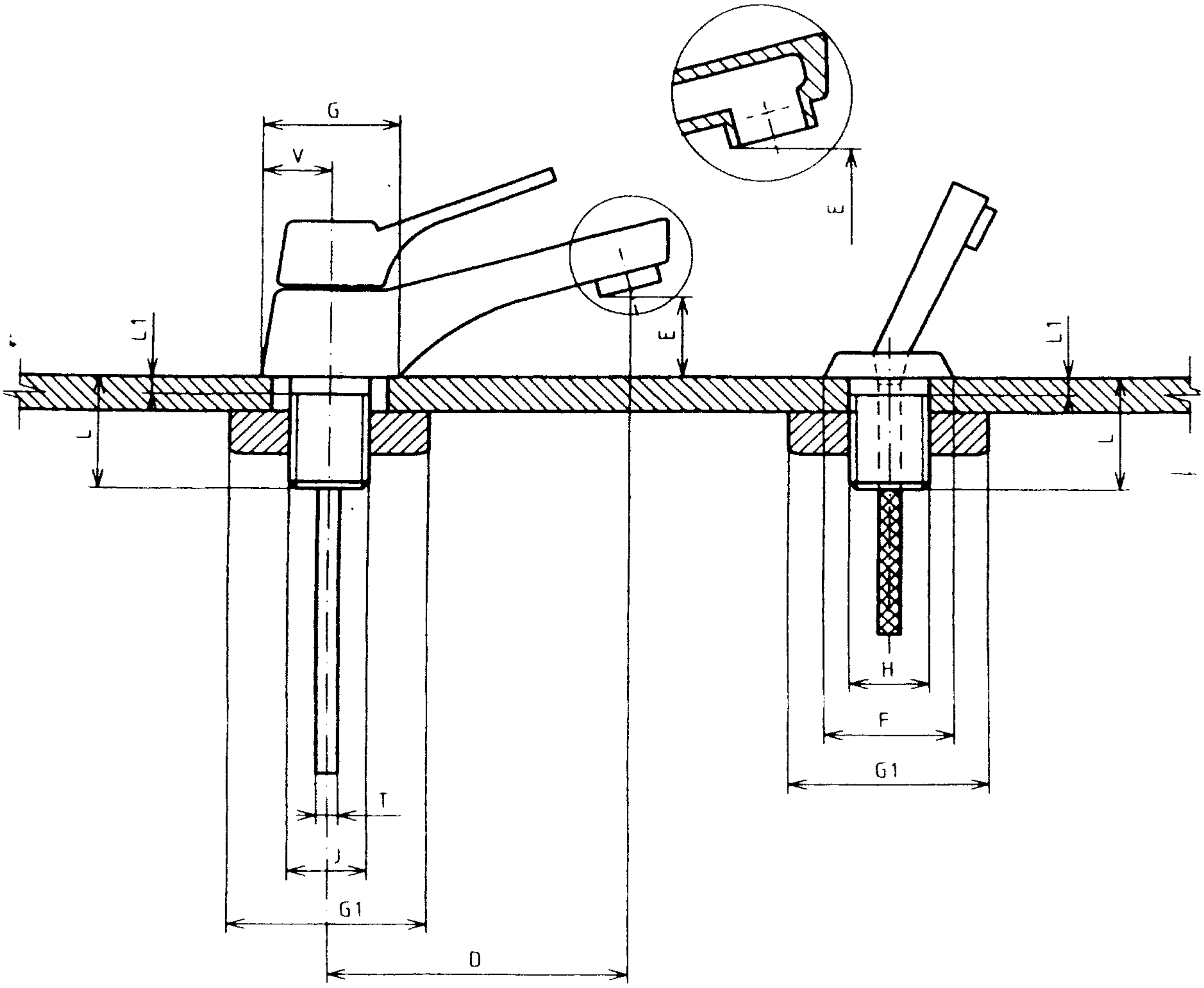


Figure 1b) — Remote spray attachment

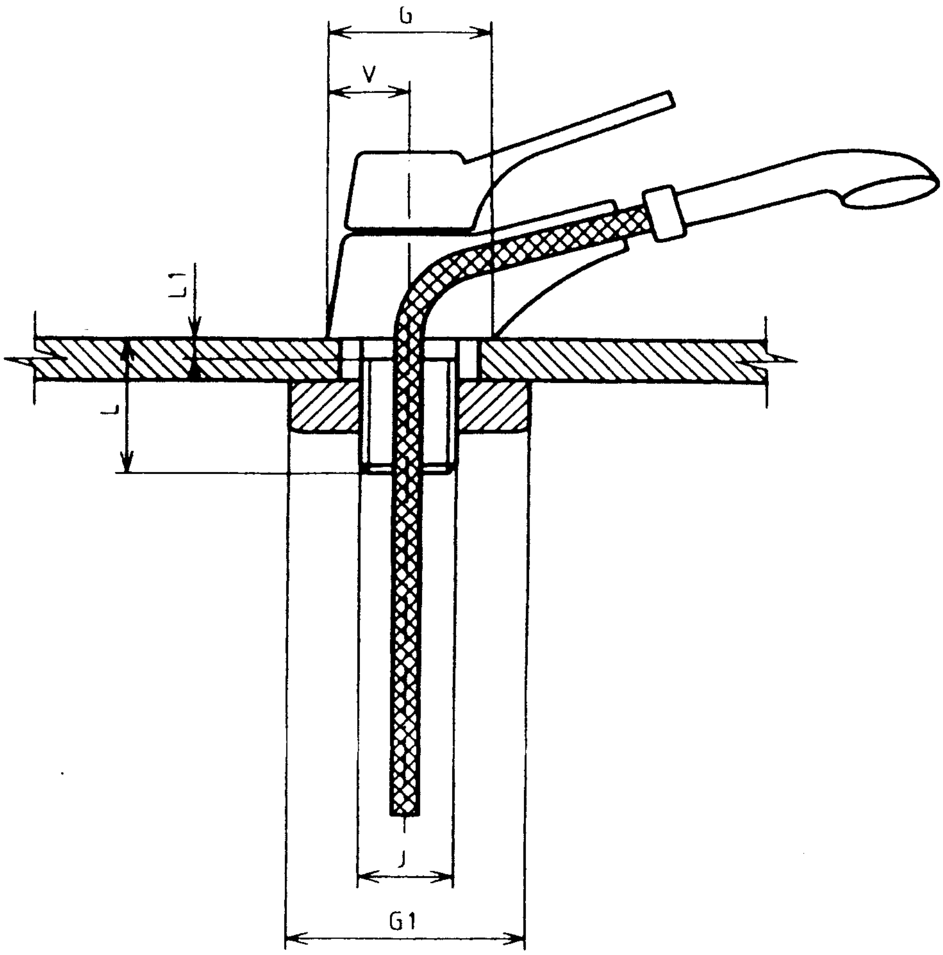


Figure 1c) — Integral spray attachment

8.2.1.3 *Flexible hoses for water supply*

Dimensions in millimetres

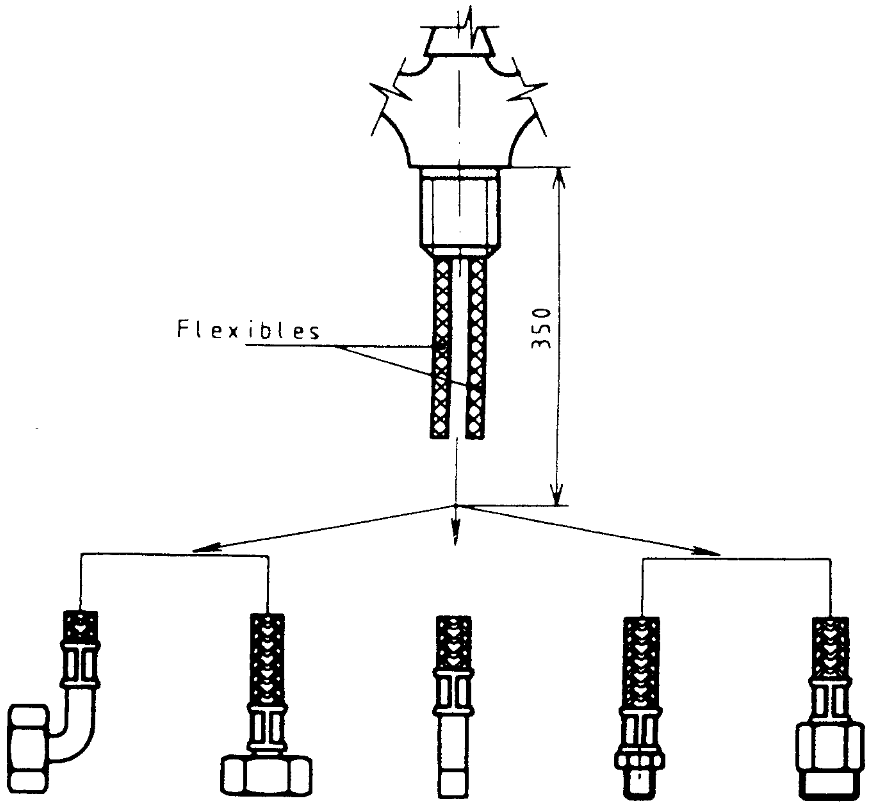


Figure 2 — Flexible hoses for water supply

NOTE Supply hoses can be used with the mixers shown in Figures 1a), 1b), 1c), 5 and 6. Other methods of connection to the supply are permissible.

Table 3 — Single-hole visible body mixing valves with or without spray attachment
[see Figures 1a), 1b), 1c)]
Mixing valves with remote outlet (Figures 5 and 6)

Dimensions	Values in millimetres	Comments
D	100 min.	Dimension from the centre of outlet, as supplied, i.e. orifice with or without flow rate regulator
E	25 min.	Dimension from lowest point of the outlet orifice to the mounting surface
F	42 min., wash basin, bidet, sink, bath	Smallest dimension of the remote spray attachment base
G	45 min.	Smallest dimension of the mixer base
G1	External diameter 50 max.	Clamping washer
H	29 max.	Shank diameter of remote spray attachment
J	33,5 max.	The two inlet pipes and retention stud shall be contained in a circle of diameter J
L and L1	Dimensions which allow mixers to be fitted on to supports of thickness between 1 mm and 18 mm	
T	Copper tube with an external diameter of 10 or 12	Plain or G 3/8 male or female thread or G 1/2 male or female thread
	Hose in accordance with **8.2.1.3**	Plain end with an external diameter of 10 mm or 12 mm or with G 3/8 male or female thread or G 1/2 male or female thread
U	350 min.	
V	35 max. for baths 32 max. for wash basins, bidets and sinks	Projection of mixing valves base to rear, measured from axis of diameter J.
NOTE Dimensions J, T and U are not for baths and are left to the discretion of the manufacturer.		

8.2.2 ***Two-hole mechanical mixing valves with visible body mounted on horizontal surface*** (see Table 4 and Figure 3)

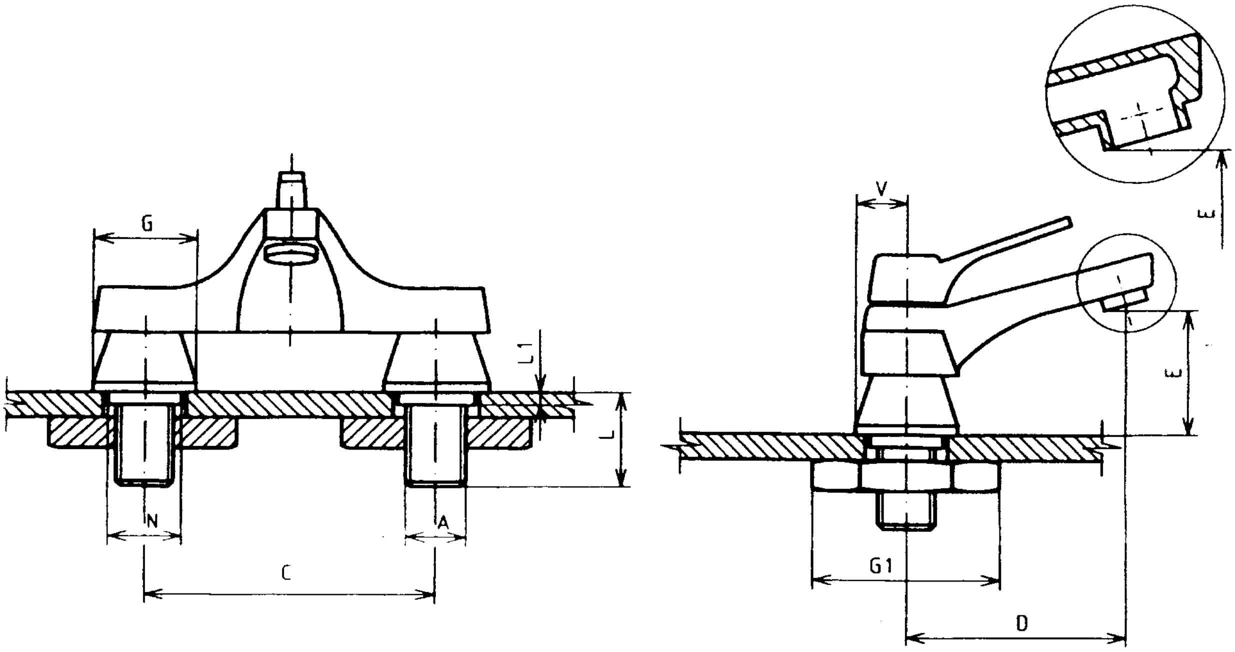


Figure 3 — Two hole mechanical mixing valves with visible body on horizontal surface

Table 4 — Two hole mechanical mixing valves with visible body on horizontal surface

Dimension	Values in mm	Comments
A	G 1/2 B: Basin, bidet and sink G 3/4 B: Baths	See ISO 228-1
C	Wash basin/bidet/sink: $200^{+3,5}_{-1}$ Bath only 150 ± 1 180 ± 1	
D	100 min.	Dimension from the centre of outlet orifice, as supplied i.e. with or without flow rate regulator
E	25 min.	Dimension from lowest point of the outlet orifice to the mounting surface
G	Wash basin/bidet/sink: 42 min. Bath: 45 min.	Smallest dimension of the base
G1	External diameter: 50 max.	Clamping washer
L and L1	Dimensions which allow mixers to be fitted on to supports of thickness between 1 mm and 18 mm and connection with the water supply	
N	24 max.	
V	35 max. for baths 32 max. for wash basins, bidets and sinks	Projection of mechanical mixing valves flange to rear measured from axis of diameter A

8.2.3 ***Dimensions of connecting ends*** (see Figure 4 and Table 5)

If the connecting ends are machined to accept a supply tube (e.g. type 1 or type 2 or type 3) the dimensions shall be as given in Table 5.

Dimensions in millimetres

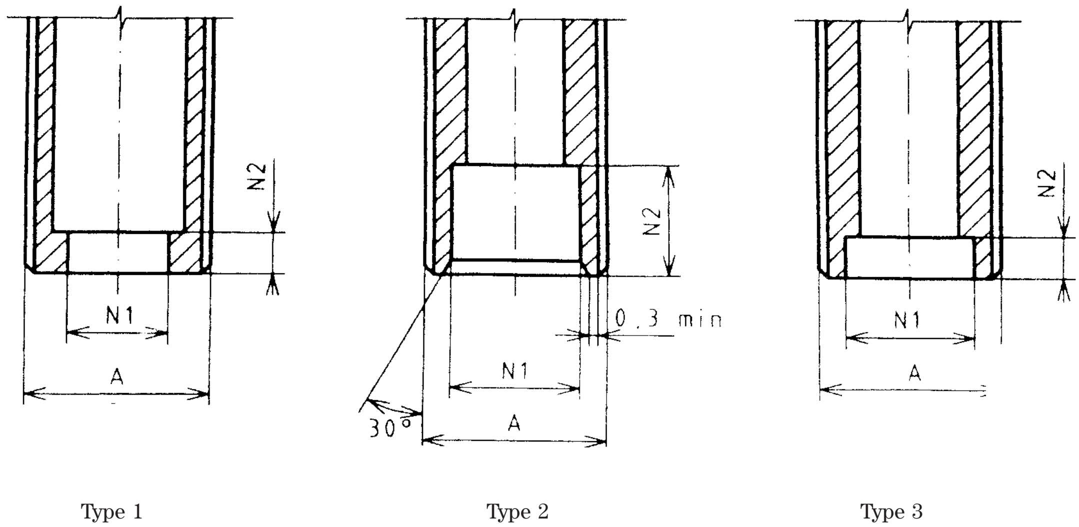


Figure 4 — Dimensions of connecting ends

Table 5 — Dimensions of connecting ends

Dimension	**Values in millimetres**			
	Type 1	**Type 2**	**Type 3**	
N1	12.3 $^{+0,2}_{0}$	15,2 ± 0,05	14,7 $^{+0,3}_{0}$	19,9 $^{+0,3}_{0}$
N2	5,0 min.	13,0 min. with a 30° chamfer and a flat of 0,3 min. at the entry to the bore	6,4 min.	6,4 min.
A	G 1/2 B	G 1/2 B	G 1/2 B	G 3/4 B

8.2.4 ***Mechanical mixing valves with remote outlet*** (see Table 3)

8.2.4.1 *Mixing valves with separate spray attachment*

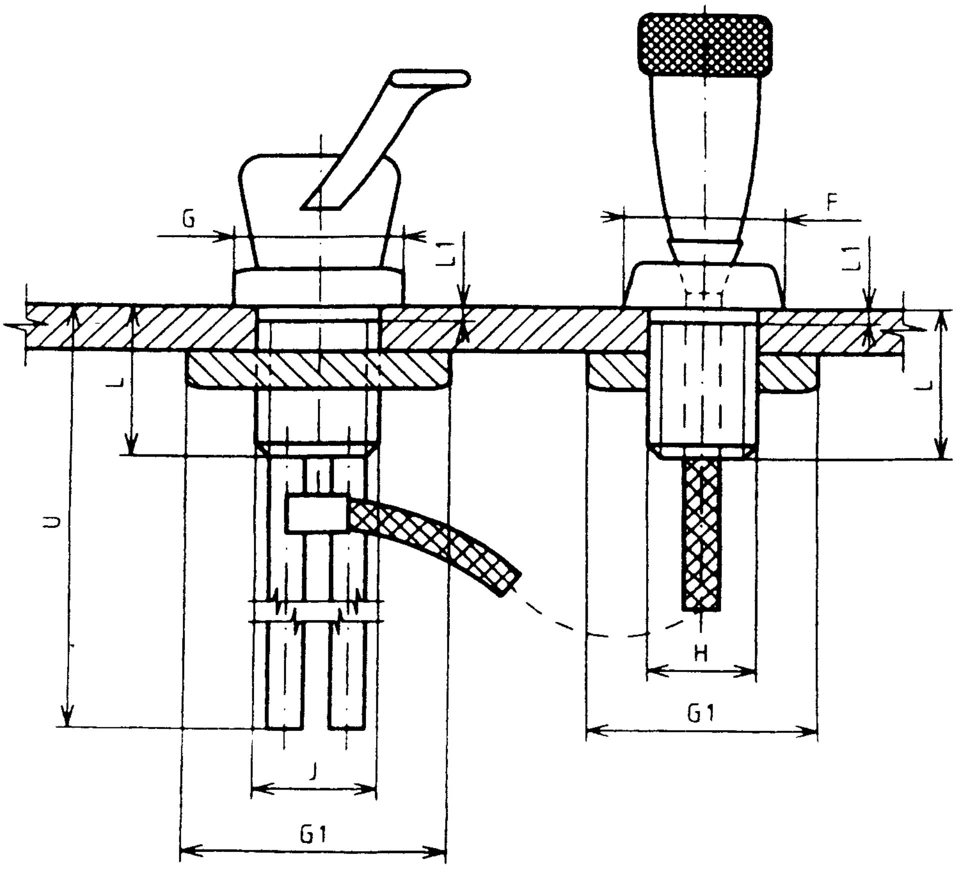


Figure 5 — Mechanical mixing valve with remote spray attachment

8.2.4.2 *Mixing valves with separate nozzle outlet*

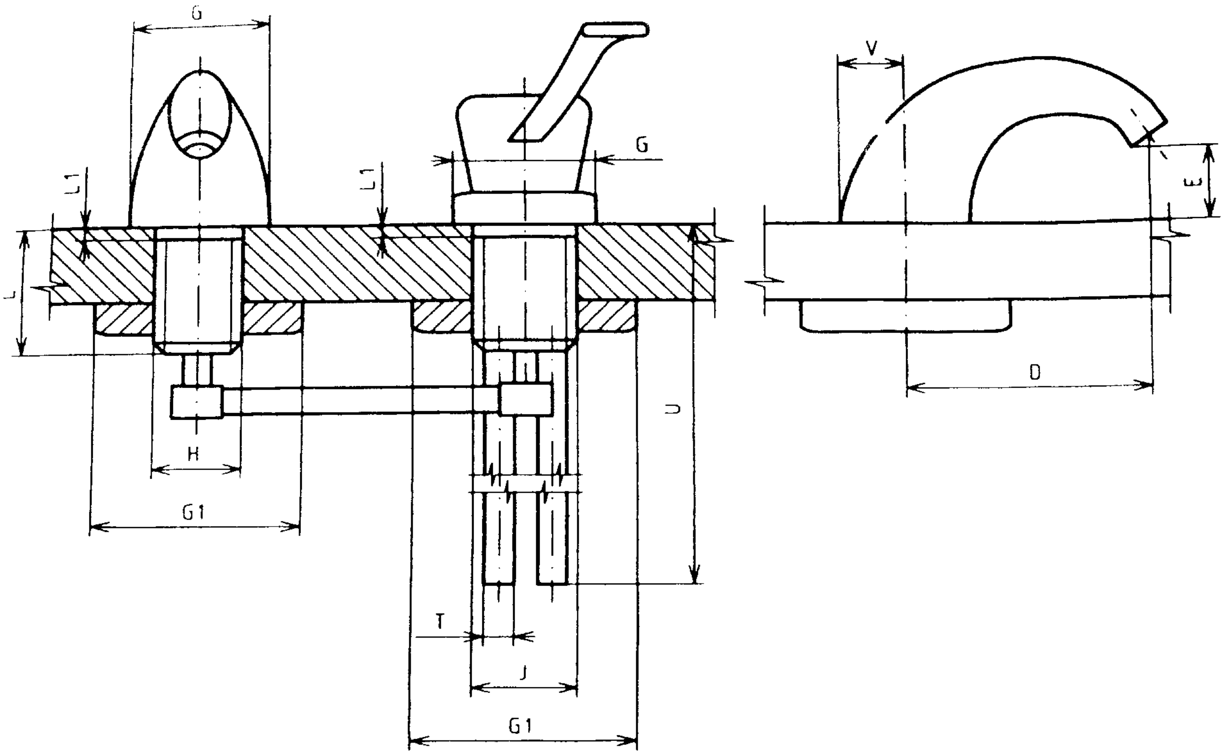


Figure 6 — Mechanical mixing valves with separate nozzle outlet

8.2.5 ***Mechanical mixing valves remotely mounted from sanitary appliance***

The design, execution and dimensions are left to the discretion of the manufacturer. The connecting threads shall comply with ISO standards.

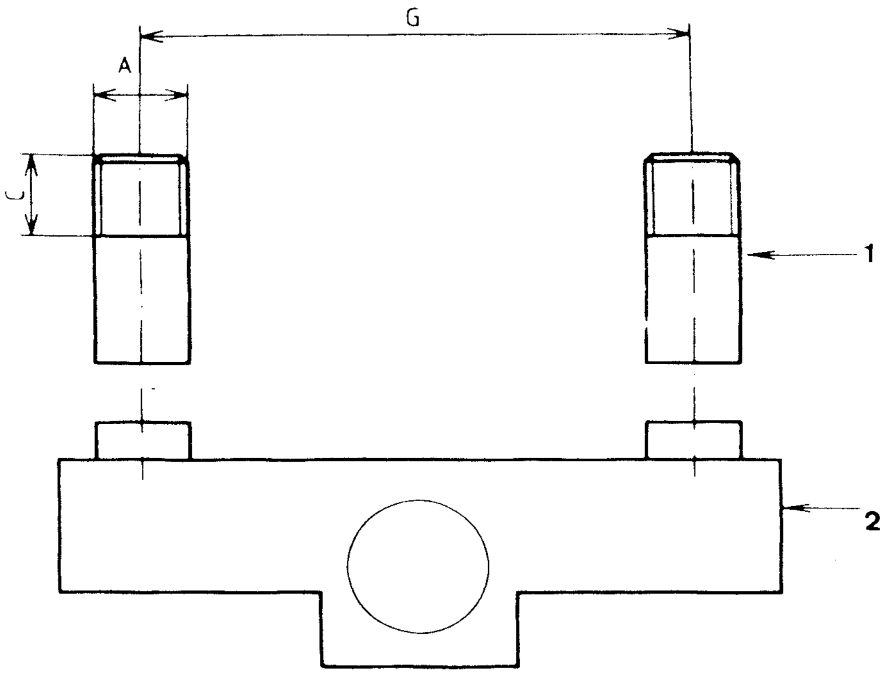
If the air gap ($E \geq 25$ mm) is not complied with, a suitable backflow protection device in accordance with prEN 1717 is required.

8.3 Mechanical mixing valves mounted on vertical surfaces

The specified dimensions of mixers allow the different possibilities of connections to the water supply.

8.3.1 ***Two hole mechanical mixing valves with visible body***

8.3.1.1 *With straight unions* (see Figure 7)

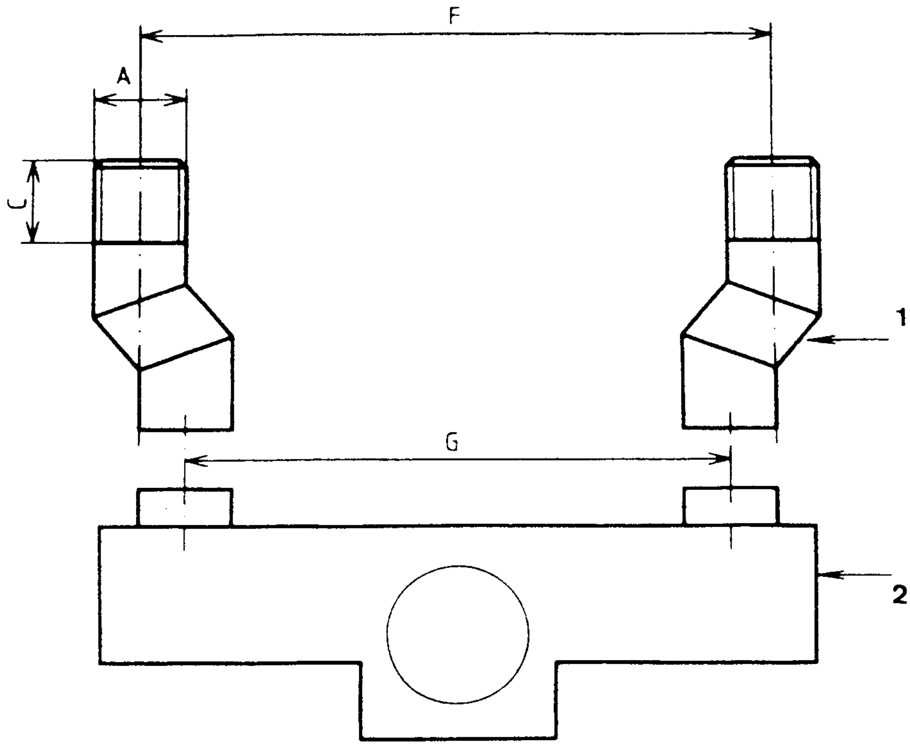


Key

1 Straight union
2 Mixing valve

Figure 7 — Mechanical mixing valves with straight unions

8.3.1.2 *With eccentric unions* (see Figure 8)

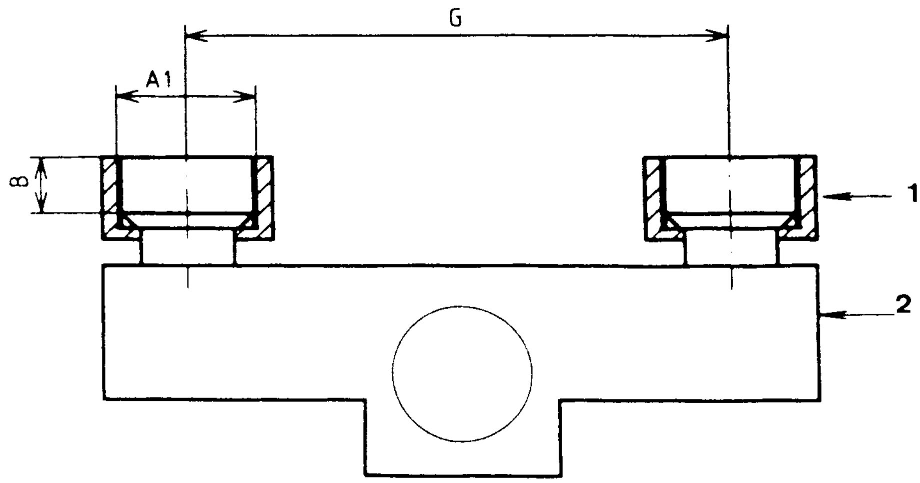


Key

1 Eccentric union
2 Mixing valve

Figure 8 — Mechanical mixing valves with eccentric unions

8.3.1.3 *With captive nuts* (see Figure 9)



Key

1 Captive nut
2 Mixing valve

Figure 9 — Mechanical mixing valves with captive nuts

Table 6 — Connection dimensions (see Figures 7, 8 and 9)

Dimension	Values in millimetres	Comments
A[1)]	G 1/2 B or 3/4 B	ISO 228-1
A1	G 3/4	ISO 228-1
B	9 min.	Useful thread length (excluding washer)
C	15 min.	Useful thread length
F	140 to 160	Extension of this range is permitted
G	150 ± 1	

[1)] It is permitted to serrate or knurl this thread to assist the retention of sealing tape or compounds. In such cases the lower deviation tolerance on the basic major diameter indicated in ISO 228-1 may be increased to −0,35 mm. The use of deformable washers is permitted.

8.3.2 ***Outlet dimension*** (see Figure 10 and Table 7)

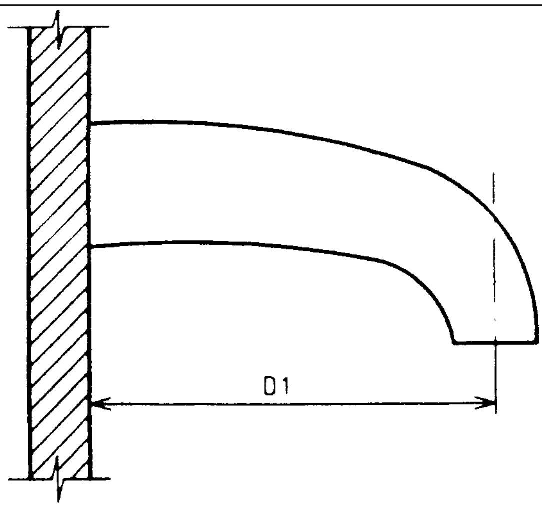


Figure 10 — Mechanical mixing valves mounted on vertical surface. Outlet dimension

Table 7 — Outlet dimension

Dimension	Values in millimetres	Comments
D1	115 min.	The actual manufacturing dimension shall be such that the mixer can fulfil its function depending on the sanitary appliance for which it is intended

8.3.3 ***Mechanical mixing valves with concealed or single hole body***

The design and dimensions are left to the discretion of the manufacturer. The connecting threads shall comply with ISO 228-1.

8.4 Dimensions of water outlets

8.4.1 ***Nozzle outlets for use with flow rate regulators***

When nozzle outlets are used with flow rate regulators:

a) conforming with EN 246, dimensions are indicated in Tables 8 and 9;

b) not conforming with EN 246, those mechanical mixing valves are covered by **8.5**.

In order to ensure interchangeability of flow rate regulators, the manufacturing tolerances chosen for the connecting threads of the outlets shall be compatible with those of the standard connecting threads of the flow rate regulators.

8.4.1.1 *Nozzle outlet for flow rate regulator with internal thread* (see Figure 11 and Table 8)

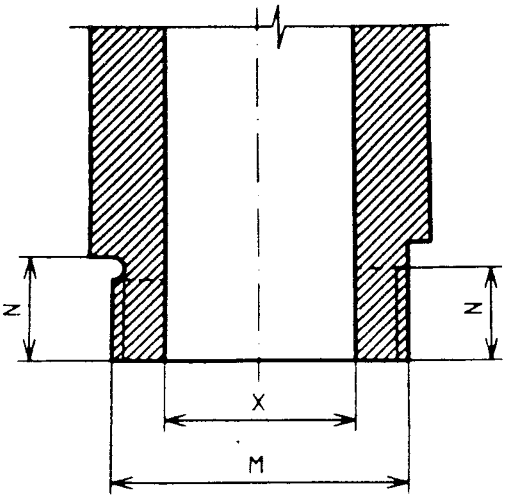


Table 8 — Dimensions for nozzle outlet

Values in millimetres

M	M 22 × 1 − 6 g
X	∅ 14 min. to 17 max.
N	4,5 min.

Figure 11 — Nozzle outlet for flow rate regulator with internal thread

8.4.1.2 *Nozzle outlet for flow rate regulator with external thread* (see Figure 12 and Table 9)

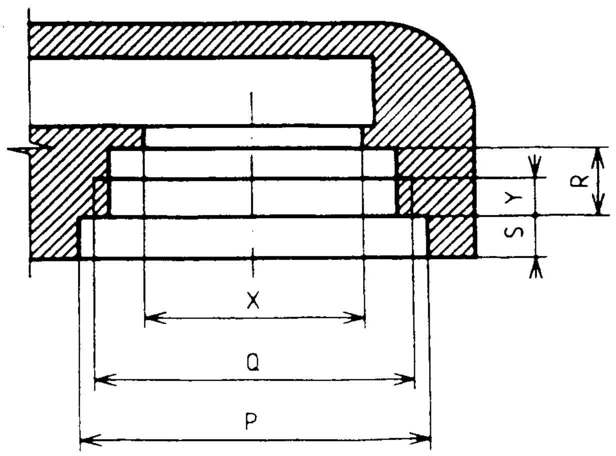


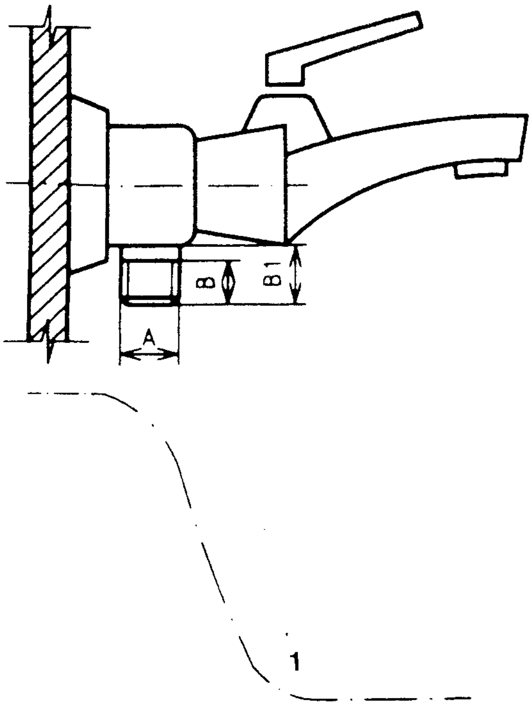
Table 9 — Dimensions for nozzle outlet

Values in millimetres

Q	M 24 × 1 − 6 H	M 28 × 1 − 6 H
P	Diameter 24,2 min.	Diameter 28,3 min.
R	4,5 ± 0,2	6 ± 0,2
S	1,5 to 4,5	3,5 to 9,5
X	∅ 14 min. to 17 max.	∅ 15 min. to 19 max.
Y	3 min.	4,5 min.

Figure 12 — Nozzle outlet for flow rate regulator with external thread

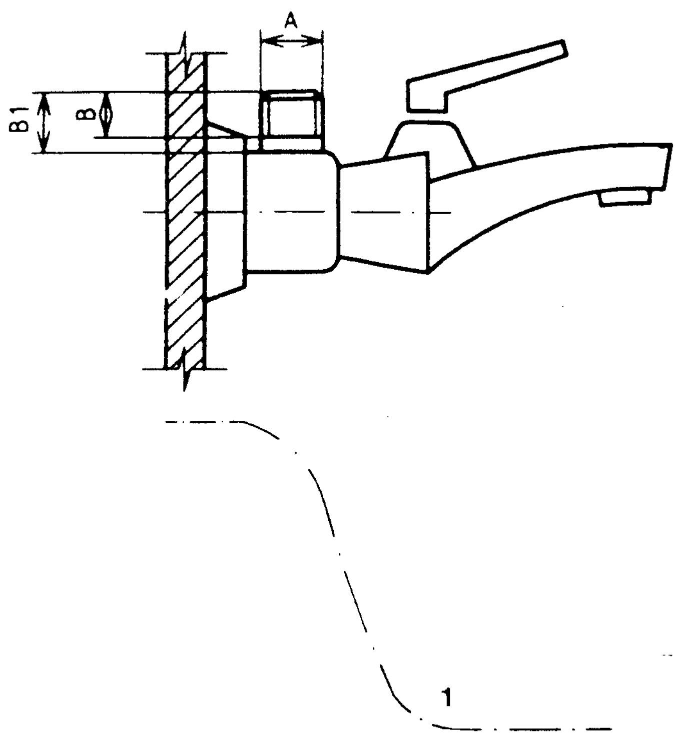
8.4.2 ***Shower outlet connection*** (see Figures 13, 14 and Table 10)



Key

1 Bath

Figure 13 — Downward shower outlet



Key

1 Bath

Figure 14 — Upward shower outlet

Table 10 — Shower outlet — Dimensions

Dimension	Values in millimetres	Comments
B	7,5 min.	Connecting thread for shower hoses Useful thread length
B1	9,5 min.	Free length for connecting nut
A	G 1/2 B[1)] or G 3/4 B	ISO 228-1

[1)] Preferred dimension.

There shall be sufficient space between the wall and the shower connection to allow tightening, release and appropriate directional adjustment of the shower connections.

8.5 Special cases

8.5.1 *Special low pressure mechanical mixing valves for installation on horizontal surfaces*

Mechanical mixing valves intended for special application, e.g. for installation on sanitary appliances not conforming with European Standards where dimensional interchangeability is not a requirement etc., can incorporate dimensional deviations, provided:

— all other requirements of this standard are satisfied;

— secure fixing to the mounting surface is provided with all fixing holes covered and watertight connections to the supplies achieved;

— water can be delivered without undue splashing;

— the air gap is $E \geq 25$ mm. If E is less than 25 mm an additional backflow prevention device is necessary in accordance with prEN 1717;

— the manufacturer's literature, including the installation instructions supplied with the tapware, indicates clearly that this tapware is a special case.

8.5.2 *Special low pressure mechanical mixing valves for installation on vertical surfaces*

Mechanical mixing valves with a visible body intended for special applications, where interchangeability is not a requirement can incorporate dimensional deviations, provided:

— all other requirements of this standard are satisfied;

— secure fixing and watertight connections to the water supply are achieved and if connection to the pipes is by means of a thread, this shall comply with ISO 228-1;

— the manufacturer's literature, including the installation instructions supplied with the tapware, indicates clearly that this tapware is a special case.

9 Leaktightness characteristics

9.1 General

The tests described are type tests (laboratory tests) and not quality control tests carried out during manufacture.

This clause specifies test methods for verifying the leaktightness of the mixing valves and gives the corresponding specifications.

9.2 Test methods

9.2.1 *Principle*

This consists of checking, under cold water pressure, the leaktightness of:

a) the obturator (see **9.3** and **9.4**);

b) the complete mechanical mixing valve (see **9.3** and **9.5**);

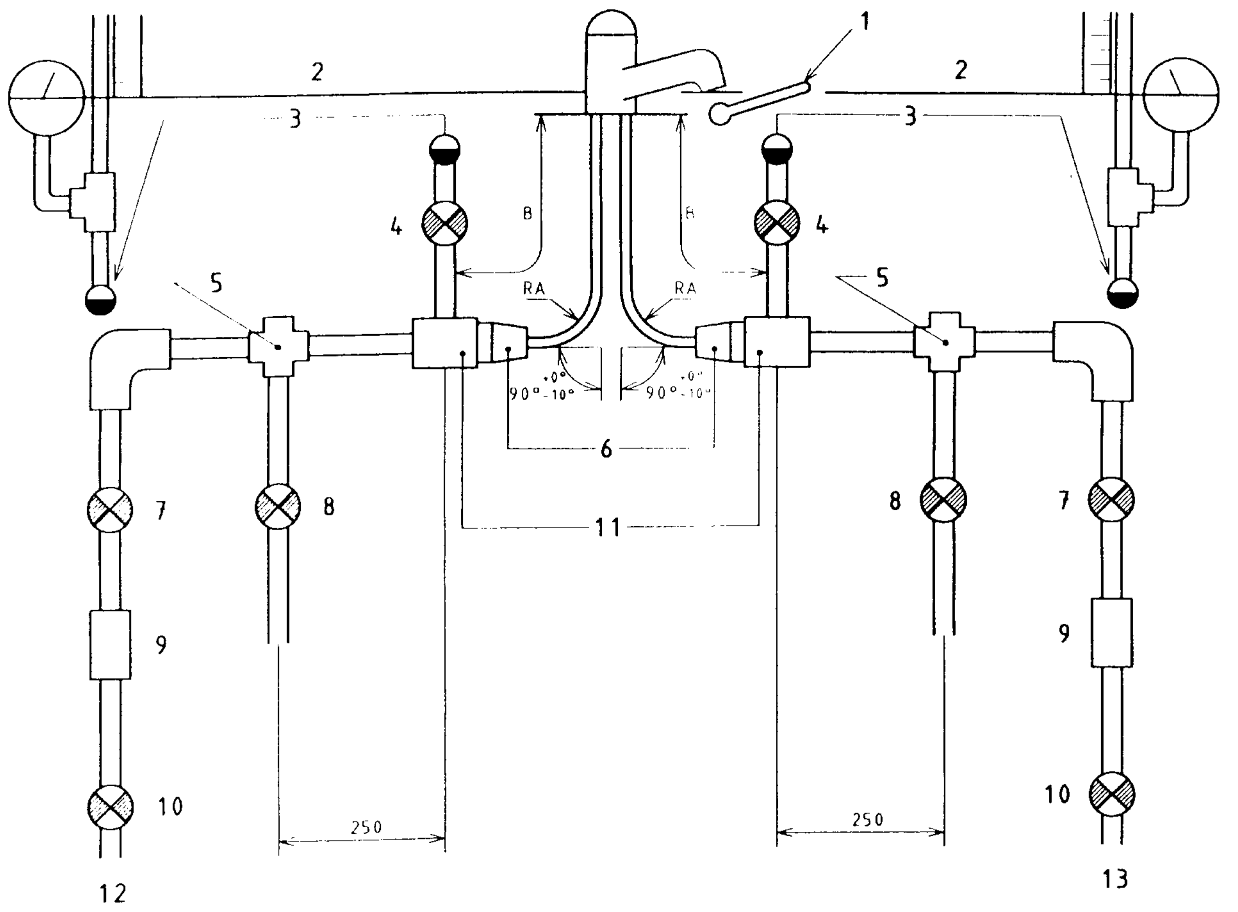
c) diverters with manual control (see **9.6**) or automatic return (see **9.7**) if provided.

Where the diverter with automatic return is regarded as performing an anti-pollution function, it shall comply with specific requirements (see clause **14**).

9.2.2 *Apparatus*

A hydraulic test circuit as shown in Figure 15 capable of supplying the static and dynamic pressures required and of maintaining them throughout the duration of the test.

Dimensions in millimetres



1 Temperature measuring device
2 Datum
3 Manometer
4 Isolating valve
5 Temperature measuring device
6 Reducing adapter (Figure A.1, Table A.1)
7 Control valve
8 Bleed valve
9 Flow measuring device
10 Stop valve
11 Pressure take off tee (Figure B.1)
12 Hot supply
13 Cold supply

Figure 15 — Hydraulic test circuit

9.3 Leaktightness of the mixing valve upstream of the obturator and of the obturator

9.3.1 ***Procedure***

— Connect the two test circuit water supplies to the mixing valve.

— With the outlet orifice open and the obturator closed, apply a water pressure of (1,6 ± 0,05) MPa [(16 ± 0,5) bar] to the mixing valves for (60 ± 5) s, for the full operating range of the temperature control device.

9.3.2 ***Requirements***

a) Verification of leaktightness upstream of the obturator;

For the duration of the test there shall be no leakage or seepage through the walls.

b) Verification of leaktightness of the obturator.

For the duration of the test there shall be no leakage at the obturator.

9.4 Leaktightness of the obturator: cross flow between hot water and cold water

9.4.1 ***Procedure***

— Connect one inlet of the mixer to the test circuit;

— With the outlet orifice open and the obturator closed, apply a water pressure of (0,4 ± 0,02) MPa [(4 ± 0,2) bar] to the mixer for (60 ± 5) s for the full operating range of the temperature control device;

— Repeat the test, reversing the water supply connection to the other inlet.

9.4.2 ***Requirements***

For the duration of the test, there shall be no leakage or seepage at the outlet or at the end of the unconnected inlet.

9.5 Leaktightness of the mixing valve downstream from the obturator

9.5.1 ***Procedure***

— Connect the two test circuit water supplies to the mixer;

— With the outlet orifice closed and the obturator open apply a water pressure of (0,4 ± 0,02) MPa [(4 ± 0,2) bar] to the mixer for (60 ± 5) s, for the full operating range of the temperature control device;

— Repeat the test with a water pressure of (0,02 ± 0,005) MPa [(0,2 ± 0,05) bar] for (60 ± 5) s.

9.5.2 ***Requirements***

For the duration of the test, there shall be no leakage or seepage.

9.6 Leaktightness of manual diverters

9.6.1 ***Procedure***

— Connect the mixing valve, in its position of use, to the test circuit.

— Put the diverter in the bath position, with the bath outlet artificially closed and the shower outlet open.

— Apply a static water pressure of (0,2 ± 0,02) MPa [(2 ± 0,2) bar] for (60 ± 5) s. Check that leaktightness is obtained on the shower outlet.

— Gradually reduce to a static water pressure of (0,02 ± 0,005) MPa [(0,2 ± 0,05) bar] for (60 ± 5) s. Check that leaktightness is obtained on the shower outlet.

— Put the diverter in the shower position with the shower outlet artificially closed and the bath outlet open.

— Apply a static water pressure of (0,2 ± 0,02) MPa [(2 ± 0,2) bar] for (60 ± 5) s. Check that leaktightness is obtained on the bath outlet.

— Gradually reduce a static water pressure of (0,02 ± 0,002) MPa [(0,2 ± 0,02) bar] for (60 ± 5) s. Check that leaktightness is obtained on the bath outlet.

9.6.2 ***Requirements***

For the duration of the test there shall be no leakage at the outlet points indicated.

9.7 Leaktightness of diverters with automatic return

9.7.1 ***Procedure***

— Connect the mixing valve, in its position of use, to the test circuit with the outlets fully open.

— Put the diverter in the bath position and apply a dynamic water pressure of (0,08 ± 0,004) MPa [(0,8 ± 0,04) bar] for (60 ± 5) s. Observe the hose attachment point and note any leakage.

— Fit to the shower outlet, the hydraulic resistance shown in Figure 16 calibrated to a flow rate of 0,15 l/s at 0,2 bar referenced to the datum shown to the hose attachment point and maintaining the pressure at (0,08 ± 0,004) MPa [(0,8 ± 0,04) bar]. Put the diverter in the flow to shower mode. Observe the bath outlet for (60 ± 5) s and note any leakage.

— With the diverter still in the shower position, reduce the dynamic pressure to a value of (0,02 ± 0,001) MPa [(0,2 ± 0,01) bar]. Check that the diverter is not dislodged. Maintain this pressure for a (60 ± 5) s and check that leaktightness is obtained on the bath outlet.

— Turn the water off. Check that the diverter returns to the bath position.

— Disconnect the hydraulic resistance and re-open the flow control and pressure measuring devices. Reapply the dynamic pressure of (0,02 ± 0,001) MPa [(0,2 ± 0,01) bar] for (60 ± 5) s. Observe the hose attachment point and note any leakage.

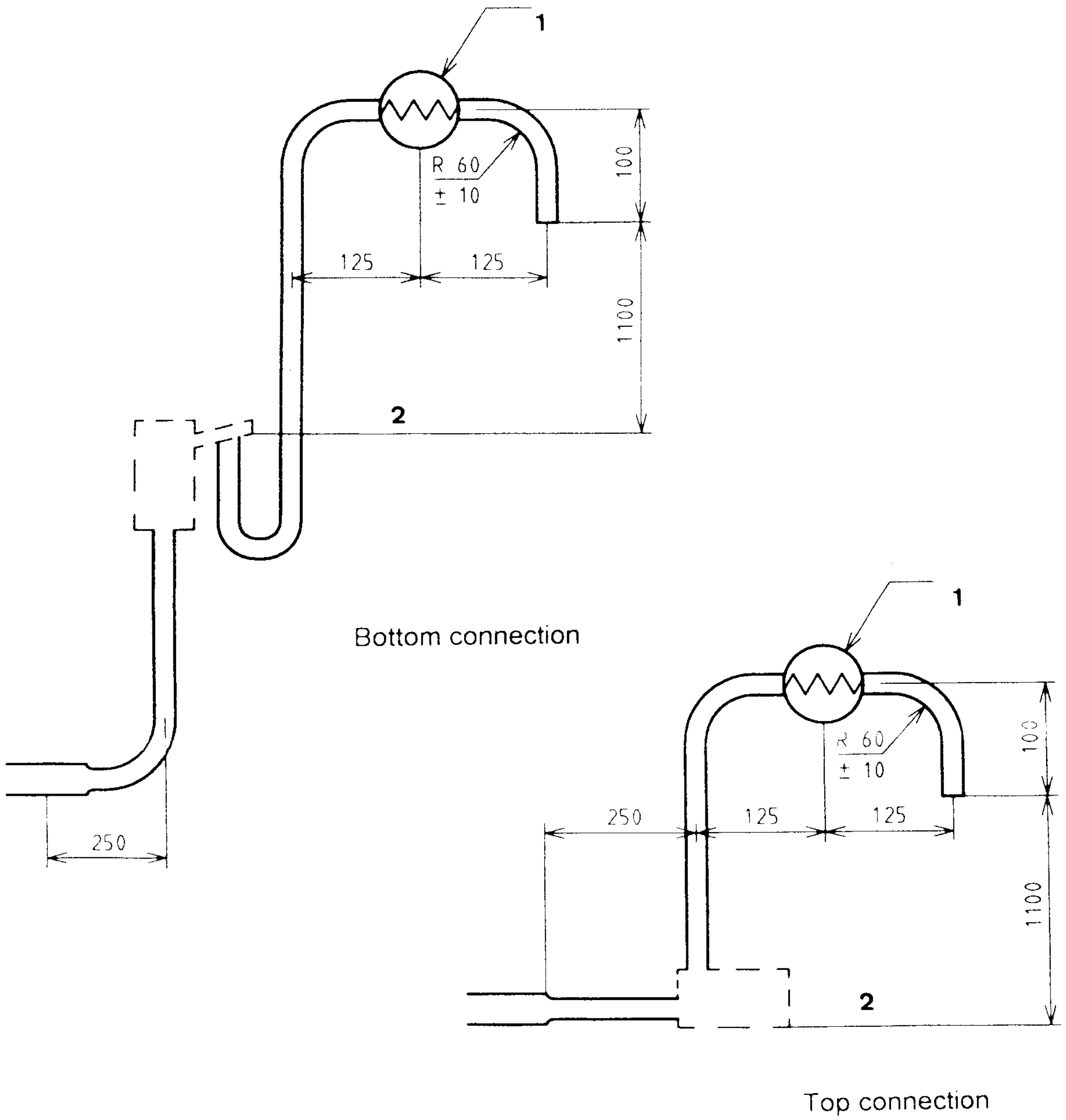
9.7.2 ***Requirements***

For the duration of the test there shall be no leakage.

9.8 Summary of requirements

A summary of requirements is shown in Table D.1 (annex D).

Dimensions in millimetres



Key

1 Hydraulic resistance
2 Datum

Figure 16 — Hydraulic resistance and supply circuits

10 Hydraulic operating characteristics

10.1 General

The test described is a type test (laboratory test) and not quality control test carried out during manufacture.

This clause specifies a test method, the aim of which is to determine the following characteristics at equal and constant pressure on the two supplies (cold water and hot water):

— flow rate (see **10.5**);

— sensitivity (see **10.6**).

10.2 Test method

The tests for verifying the characteristics from **10.5** and **10.6** are carried out either on the basis of a series of curves or representative test values for the different functions of the mixing valve.

10.3 Apparatus

The tests shall be conducted on the hydraulic test circuit shown in Figure 15 which shall be capable of supplying the static and flow pressures required and of maintaining them for the duration of the test.

The hydraulic test circuit shall be supplemented with a device without backlash for automatic or non-automatic operation at a rate of approximately 0,5°/s or 0,8 mm/s of the temperature and flow rate adjustment devices of the mixing valve.

The characteristics of the circuit and its measuring devices shall be as follows:

— hot and cold water supplies to provide water at 50 °C to 65 °C and 10 °C to 15 °C respectively;

— temperature measuring devices: Having a suitable operating range and an accuracy of 0,5 °C at the measured values;

— an outlet temperature probe: Having a suitable operating range and an accuracy of 0,5 °C at the measured values;

— pressure measuring devices: Having a suitable operating range and an accuracy of 1 % at the test pressure (datum, as shown, is the lowest point of mixing valve discharge to be used for zeroing manometers and gauges);

— flow measuring devices: Having a suitable operating range and an accuracy of 2 % of the test flow rate;

— control valves shall be capable of regulation to achieve an accuracy of 0,001 MPa (0,01 bar);

— pipework: All feed pipework to the reducing adapters to be ∅ 28 mm;

— pressure take off tee: In accordance with Figure B.1 (annex B);

— reducing adapter: In accordance with Figure A.1 and Table A.1 (annex A);

— inlet pipe connection: To suit bottom entry, side entry and wall mounted mechanical mixing valves. See Figure 17 and Table 11;

— alternative outlets: To replace outlet accessories. See Figure 18 and Table 11.

NOTE The various parameters Q_C, Q_H, Q_M and G (movement of the temperature control device) can be recorded continuously.

Q_C is the quantity of cold water;

Q_H is the quantity of hot water;

Q_M is the quantity of mixed water.

Construction — Tube to be of same nominal size as inlet connection of mechanical mixing valve

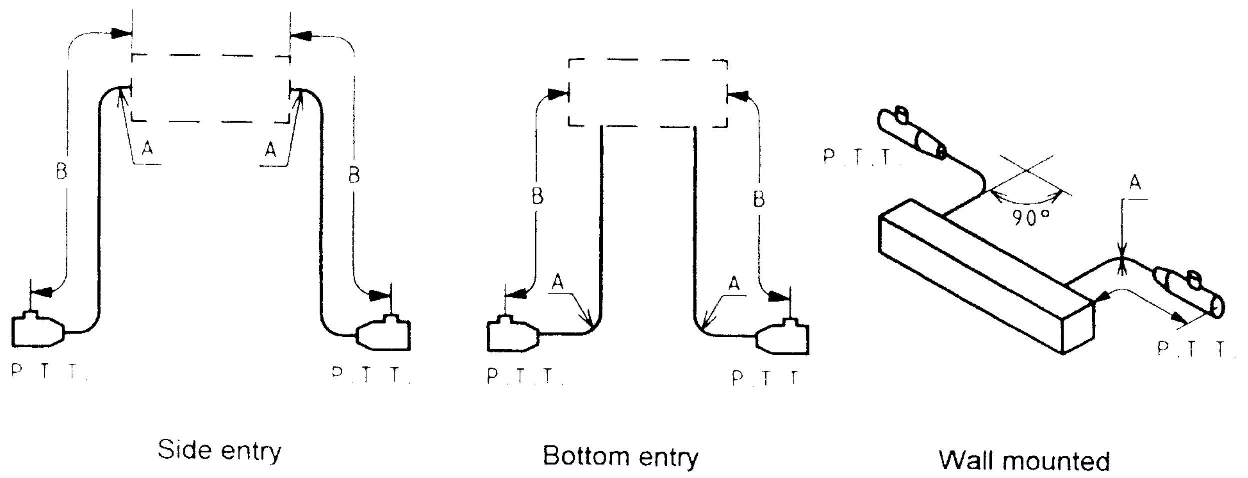
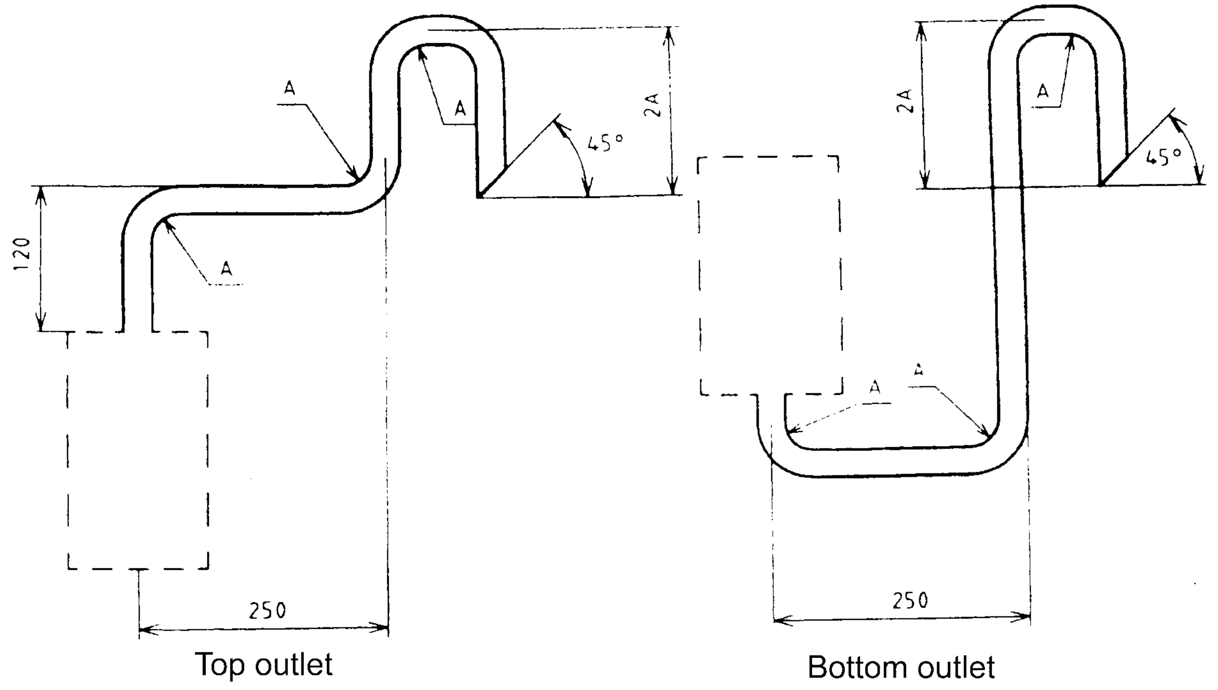


Figure 17 — Alternative inlet connection methods



Construction (copper tube)
22 mm for bath filling outlet
15 mm for all other outlets

Figure 18 — Alternative outlet arrangement

Table 11 — Dimensions of alternative inlets and outlets

A min.	Centre-line radius equal to four times the bore diameter of the inlet pipe
B ± 40 mm	500 mm Measured along the centre-line of the tube where the inlet pipework passes through the mounting surface. The measurement shall be made from the mounting surface of the mixing valve to the centre-line of the pressure take off tee (PTT). In all other cases the measurement shall be made from the inlet connection provided by the manufacturer to the centre-line of the PTT.

10.4 Mounting and initial set-up procedure

This initial procedure is necessary to ensure the required water supply conditions at the commencement of the tests in **10.5** and **10.6**.

— Connect both supplies of the mechanical mixing valve to the test circuit using the appropriate inlet connection (Figure 17). Deformable inlet connections shall be mounted in a straight position.

— Fit the automatic operating device to the temperature regulator.

— For mechanical mixing valves with a flow rate control device which is separate from the temperature control device, set it at maximum flow position. For single control mechanical mixing valves, set the flow rate control device to the position providing maximum flow.

— If the mechanical mixing valve has a flow rate regulator this is removed to give an open outlet but flow straighteners where fitted are left in place. If the mechanical mixing valve is used with accessories (e.g. remote bath nozzle diverter, shower etc.) replace the accessory with the appropriate free outlet shown in Figure 18.

— On the cold water side, supply the mechanical mixing valve with water at a temperature T of between 10 °C and 15 °C maintained to ±1 °C.

— Adjust the cold water pressure P to (0,01 ± 0,000 5) MPa [(0,1 ± 0,005) bar], with the flow control open.

— On the hot water side, supply the mechanical mixing valve with water at a temperature T between 60 °C and 65 °C maintained to ±1 °C, so that ΔT = 50 K.

— Adjust the hot water pressure P to (0,01 ± 0,000 5) MPa [(0,1 ± 0,005) bar], with the flow control open.

— When these adjustments have been made, return the flow control device to the off position, with the mechanical mixing valve under pressure.

10.5 Determination of flow rate

10.5.1 ***Principle***

To determine the flow rate of the mechanical mixing valve under test at a dynamic reference pressure of (0,01 ± 0,000 5) MPa [(0,1 ± 0,005) bar], applied to the hot and cold water supplies, for the full extent of the temperature control range.

The measurement is made of the maximum available flow rate going from cold to hot and then from hot to cold.

Where the mechanical mixing valve has more than one outlet, each shall comply with the hydraulic requirements.

10.5.2 ***Procedure***

Operate the temperature control device at a pressure of (0,01 ± 0,000 5) MPa [(0,1 ± 0,005) bar], with any flow rate control fully open.

For various temperatures measure the flow rates Q_M of mixed water ($Q_M = Q_C + Q_H$) (at least the five indicated):

— full cold position;
— 34 °C;
— 38 °C;
— 42 °C;
— full hot position.

10.5.3 ***Requirements***

All of the readings of "flow rate" at (0,01) MPa [(0,1 bar)] shall be within the appropriate range in Table 12.

The series flow rate is used for setting up test parameters in other tests where specified.

On the basis of the results of the tests carried out in accordance with **10.5.2**:

1) For wash basins, bidets and sinks and showers, verify that the flow rates are not less than the values specified in this subclause for the five specified temperatures.

2) For baths, verify that between 34 °C and 42 °C the flow rate is greater than or equal to 15 l/min (0,25 l/s) and for hot and cold water full the flow rate is not less than 14 l/m (0,23 l/s).

10.6 Sensitivity

10.6.1 ***Principle***

To determine the sensitivity of the movement of the temperature control device within the reference range of 34 °C to 42 °C.

10.6.2 ***Procedure***

Operate the temperature control device at a rate of approximately 0,5° angular/s or 0,8 mm/s with a pressure of (0,01 ± 0,000 5) MPa [(0,1 ± 0,005) bar] and measure the mixed water temperature as a function of the movement of the temperature control device with any flow rate control being fully open.

In the event of linear movement, take the measurement at the end of the control device (for levers).

When the temperature control device reaches the end of its movement return the device to its starting position.

If there is any doubt about the curve, repeat the test manually, with the appliance mounted in its normal installation position and compare the results.

The most favourable result is used.

10.6.3 ***Evaluation of results***

On the basis of the measurements carried out in **10.6.2** plot the curves of mean mixed water temperature T as a function of the movement G of the temperature control device.

From the curves obtained in this way, determine the two values of ranges $G1$ and $G2$ for the mixed water temperature zone between 34 °C and 42 °C.

Verify that the smaller of these two values $G1$ and $G2$ complies with the requirements of **10.6.4**.

Table 12 — Flow rates

Series	Series flow rate min. l/min	Flow rate at 0,01 MPa (0,1 bar)	Application
80	4,8	0,080 to 0,1 l/s (4,8 to 6,0 l/min)	Wash basins
100	6,0	0,100 to 0,125 l/s (6,0 to 7,5 l/min)	Showers sinks and bidets
125	7,5	0,125 to 0,25 l/s (7,5 to 15,0 l/min)	
250	15,0	min. 0,25 l/s (min. 15 l/min) min. 0,23 l/s (min. 14 l/min in cold and hot positions)	Baths

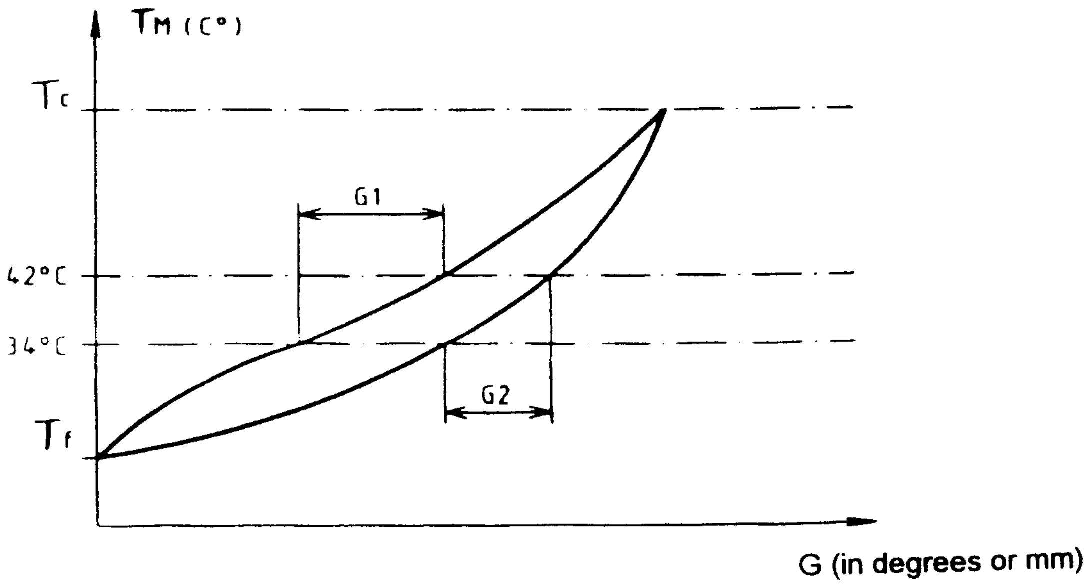


Figure 19 — Sensitivity curve

10.6.4 ***Requirements***

The adjustment range shall be such that the minimum linear movement of the temperature control device required for a variation of 8 K in the reference range is at least equal to 10 mm for sinks and 12 mm for baths, wash basins, bidets, showers. Specially designed mechanical mixing valves which do not meet the requirements of linear movement with set values, may be accepted in accordance with the standard, if the verified sensitivity is judged to be equivalent to the requirements of the standard.

In the case of a bath/shower mechanical mixing valve, the measurement will be made for the shower outlet only.

NOTE Manufacturers are given a period of five years from acceptance of the draft standard at the formal vote stage to ensure that their product complies with this requirement.

11 Mechanical performance under pressure

11.1 General

The tests described are type tests (laboratory tests) and not quality control tests carried out during manufacture.

The principle of the test is to show any deformation of the mixing valve which might occur under high cold water pressure. The test is carried out upstream and downstream of the obturator.

11.2 Apparatus

A hydraulic test circuit capable of supplying and maintaining the required pressures for the duration of the test.

11.3 Testing the mechanical performance upstream of the obturator — Obturator in the closed position

11.3.1 ***Procedure***

Apply a static water pressure of (2,5 ± 0,05) MPa [(25 ± 0,5) bar] for (60 ± 5) s to both inlets simultaneously.

11.3.2 ***Requirement***

For the duration of the test, there shall be no permanent deformation of the mixing valve situated upstream of the obturator.

11.4 Testing the mechanical performance downstream of the obturator — Obturator in the open position

11.4.1 ***Procedure***

With the obturator(s) in the open position, apply a water pressure of (0,2 ± 0,02) MPa [(2 ± 0,2) bar] for (60 ± 5) s of flow, this pressure being measured at the point of connection of the mixing valve to the pipework. The test is carried out on the mixing valves as supplied. For mixing valves with a removable flow rate regulator at the outlet, the test is carried out with and without this regulator.

11.4.2 ***Requirement***

For the duration of the test, there shall be no permanent deformation of the mixing valve.

12 Mechanical endurance characteristics

12.1 Mechanical endurance of the control device

12.1.1 ***General***

The tests described are type tests (laboratory tests) and not quality control tests carried out during manufacture.

This clause specifies a test method to verify the mechanical endurance of the control device of mechanical mixers and gives the corresponding specifications.

12.1.2 ***Requirements***

During the test, no component fracture, sticking or leakage shall occur.

The operating torque for flow rate adjustment and temperature adjustment shall not exceed 3 N·m during the test.

Verify that at the commencement of each 4 h interruption (see **12.1.3.3**) and after 70 000 cycles, the leaktightness requirements (see **9.1** to **9.4**) are still met.

12.1.3 ***Test method***

12.1.3.1 *Principle*

This consists of subjecting the control device to a specific number of movements, (with a dwell time) at specified cold water and hot water pressures and temperatures.

For mixing valves with separate controls for flow rate and temperature, the test shall be carried out on each of these devices.

For mixing valves with single lever control, the test is carried out for the indicated lever position specified in **12.1.3.2.2**.

12.1.3.2 *Apparatus*

This comprises two supply circuits (hot water, cold water) and an automatic machine.

12.1.3.2.1 *Supply circuit*

Two supply circuits, each comprising a pump or similar device, capable of supplying the required pressure to each circuit, at a temperature ≤30 °C for the cold water and (65 ± 2) °C for the hot water.

12.1.3.2.2 *Automatic machine*

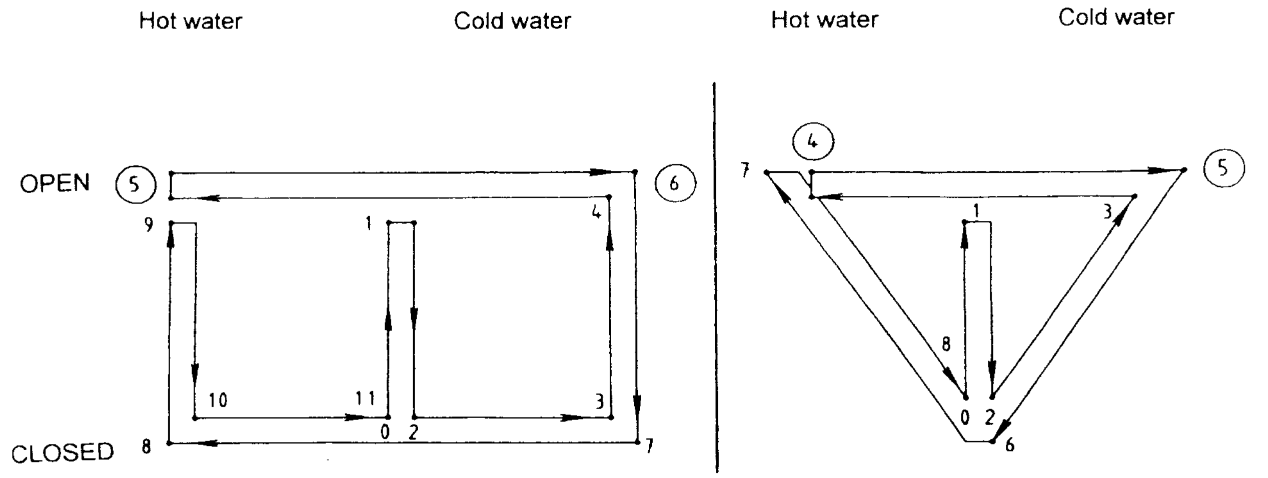
The machine's mechanism shall carry out one of the cycles defined in **12.1.3.3**, according to the movement of the mixer.

For rectangular movement one cycle consists of three opening and closing movements and two complete cold water, hot water, cold water movements.

For triangular movement one cycle consists of three opening and closing movements and one complete cold water, hot water, cold water movement.

Table 13 — Test conditions for mechanical performance

Pressure applied	Obturator	Outlet orifice	Cold water test Test conditions		Requirements
			Pressure	Duration	
Upstream of obturator	closed	open	Static (2,5 ± 0,05) MPa (25 ± 0,5) bar	(60 ± 5) s	No permanent deformation
Downstream of obturator	open	open	Dynamic (0,2 ± 0,02) MPa (2 ± 0,2) bar	(60 ± 5) s	No permanent deformation



One cycle 0 to 11
Rectangular movement (a)

One cycle 0 to 8
Triangular movement (b)

Continuous movements ensuring leaktightness on closure equal to approximately 95 % of the total travel

Figure 20 — Rectangular and triangular movements

12.1.3.3 *Procedure*

Install the mixing valve on the machine and connect it to both the cold water supply circuit and the hot water supply circuit.

Set the maximum force (*F*) transmitted by the machine to open and close the flow control and to move the temperature control to a torque *C* of 3 N·m. The machine shall stop if this torsional resistance value is reached on the mechanism (see Figure 21).

With the mixing valve closed, set the hot water and cold water static pressures upstream of it at the values given in Table 13.

The test is interrupted each week for a period of 4 h. The mixing valve is kept in the closed position and under pressure. The watertightness tests shall be carried out at the beginning of the 4 h interruption.

The mixing valve under test shall be connected to the machine in its normal position of use.

Eccentric forces, which may cause abnormal wear on the mixing valve, originating from horizontal or vertical movements of the machine, shall be eliminated.

Subject the mixing valve to 70 000 cycles of opening and closing, each cycle comprising (see Figure 20):

a) for rectangular movements:

- 0 Start in mean mixed closed position;
- 1-2 Open in mean mixed position — closed;
- 3 Move to cold water position (position 3);
- 4 Open in cold water position (position 4);
- 5 Move to full open hot water position (position 5) — Time delay 5 s;
- 6 Move to cold water position (position 6) — Time delay 5 s;
- 7 Close in cold water position (position 7);
- 8 Move to closed hot water position (position 8);
- 9 Open in hot water position (position 9) and close (position 10);
- 10 Return to closed mixed position (position 11).

b) for triangular movements:

- 0 Start in mean mixed closed position;
- 1 Open in mean mixed position;
- 2 Return to closed position;
- 3 Open in full cold water position;
- 4 Move to full hot water position — time delay 5 s;
- 5 Move to full cold water position — time delay 5 s;
- 6 Return to mixed closed position (position 6);
- 7 Open in full hot water position;
- 8 Close, return to position 0.

c) for dual control subject each control device to the relevant part of the rectangular movement series of tests.

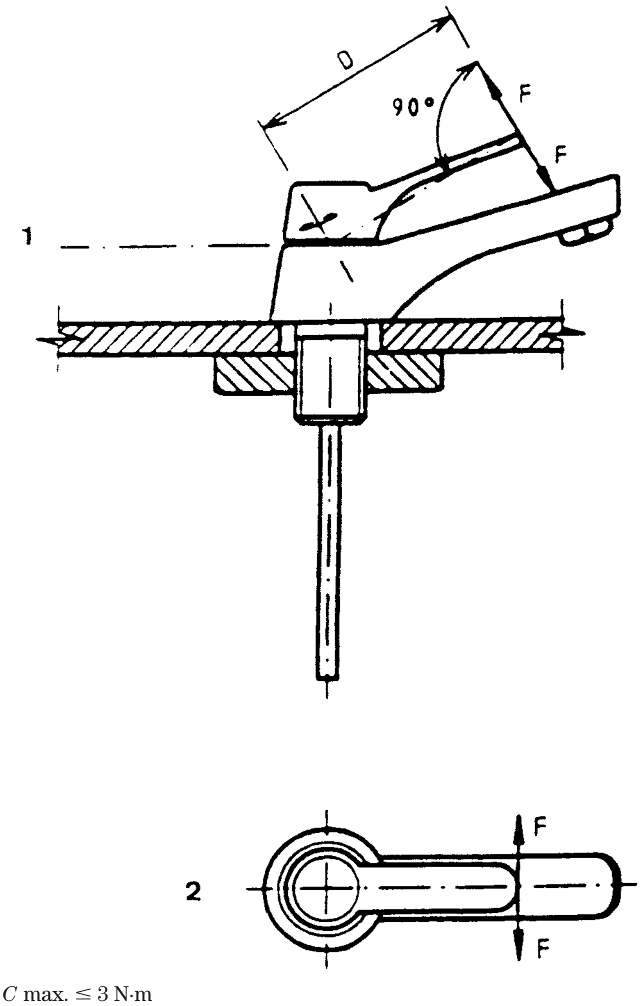
12.1.3.4 *Verification*

During the test, record any incidents: failure of leaktightness — leakage in the assembly — fracture of components — stoppage of machine due to control difficulties — etc.

After 70 000 cycles, carry out the verifications described in **12.1.2**.

Table 14 — Table of test conditions

Hot water temperature	(65 ± 2) °C
Cold water temperature	≤30 °C
Flow rate in l/min adjusted by downstream resistance	6 ± 1
Dynamic pressure in MPa (bar)	(0,01 ± 0,001) MPa (0,1 ± 0,01) bar
Static pressure in MPa (bar)	(0,02 ± 0,002) MPa (0,2 ± 0,02) bar
Speed in degrees angle/s	90° in (1,5 ± 0,2) s
Time delay in seconds	5 ± 0,2
Reversal time in seconds on each direction change	0,5 ± 0,2
pH value	8 ± 1
Water hardness	to be measured and included in the test report
Number of cycles	70 000 (rectangular or triangular or separate control movements)



C max. ≤ 3 N·m
C = *FD*
EXAMPLES
If *D* = 100 mm *F* shall be ≤30 N
If *D* = 50 mm *F* shall be ≤60 N

Key

1 Rotational axis of flow adjustment control
2 Rotational axis of temperature adjustment control

Figure 21 — Machine adjustment torque

12.2 Mechanical endurance of diverters

12.2.1 ***General***

This clause specifies two methods of test for the mechanical endurance of diverters of mixing valves: one for manual diverters and one for diverters with automatic return and gives the corresponding specifications.

12.2.2 ***Requirements***

During the test, no deformation, component fracture, blockage of the mechanism, leakage from the nozzle or shower/shower head or the diverter control joint shall be noted.

At the end of the test, check the leaktightness:

— in the conditions specified in **9.6** for manual diverters;

— in the conditions specified in **9.7** for diverters with automatic return.

12.2.3 ***Test method***

12.2.3.1 *Principle*

The principle of the test is to subject the diverter to a specified number of operations, with the mixing valve being supplied alternately with cold water, and with hot water at (65 ± 2) °C (thermal shocks), in order to test its behaviour over a period of time, taking into account temperature.

12.2.3.2 *Apparatus*

12.2.3.2.1 *Manual diverter*

— Automatic machine ensuring alternating movement of the diverter at a rate of 15 ± 1 returns per minute.

— Supply circuits comprising a pump or a similar device by means of which the required static pressure can be obtained for cold water at ≤30 °C and hot water at (65 ± 2) °C.

12.2.3.2.2 *Diverter with automatic return*

— Mechanism for moving the diverter to the shower/shower head position under the conditions defined in **9.7**.

— Supply circuits identical to those defined in **12.2.3.2.1** but also comprising a rapid closure valve coupled to the diverter mechanism on the joint circuit.

12.2.3.3 *Procedure*

12.2.3.3.1 *Manual diverter*

Mount the mixing valve, as supplied, onto the machine and connect to the supply circuit.

Connect the drive device to the diverter lever by means of a flexible component.

With the mixing valve closed, adjust the water pressure on the two supply circuits to a value not greater than 0,1 MPa (1 bar).

With the temperature control device set to the full hot position adjust the flow rate to half the series flow rate at the highest flowing outlet. This flow adjustment shall be made by means of the independently operating on/off control device or in the absence of the device by partially obstructing the outlet.

Subject the diverter to an endurance test of 30 000 cycles, each cycle comprising a return movement between the extreme positions.

Throughout the test, supply the mixing valve alternately with cold water for 15 min ± 30 s then hot water for 15 min ± 30 s.

Throughout the test, record any incidence of leaks, deformations, fracture, etc.

After 30 000 cycles, check the leaktightness of the diverter (see **9.6**).

12.2.3.3.2 *Diverter with automatic return*

Fit to the shower outlet the hydraulic resistance shown in Figure 15 calibrated to a flow rate of 0,15 l/sec at 0,2 bar.

Mount the mixing valve as fitted on to a support and connect to the supply circuit.

With the mixing valve closed, set the water pressure in the two supply circuits to not more than 0,1 MPa (1 bar)

Open the mixer supply inlet. Set the flow rate at the minimum value for the correct operation of the diverter.

With the temperature control device set to the full hot position adjust the flow rate to half the series flow rate at the highest flowing outlet. This flow adjustment shall be made by means of the independently operating on/off control device or in the absence of the device by partially obstructing the outlet.

Subject the diverter to an endurance test of 30 000 cycles, one cycle being defined as follows:

— With the diverter in the flow to bath position, allow a flow of water through the nozzle for (5 ± 0,2) s.

— Operate the diverter to move it to the shower position (by pulling or pushing).

— Allow flow through shower outlet for (5 ± 0,2) s.

— Shut off the supply (diverter returns to the bath position) reopen supply.

Throughout the test, supply the mixing valve alternately with cold water for 15 min ± 30 s then hot water for 15 min ± 30 s.

Throughout the test, record any incidence of leaks, failure to revert automatically, jamming, etc.

After 30 000 cycles, check the leaktightness and function of the diverter and record the observed deteriorations (see **9.7**).

12.3 Mechanical endurance of swivel nozzles

12.3.1 ***General***

This clause specifies a method of testing the mechanical endurance of swivel nozzles of mechanical mixing valves and gives the corresponding specifications.

12.3.2 ***Test method***

12.3.2.1 *Principle*

The principle of the test is to reciprocate the nozzle of the mixing valve, with both inlets fed with cold water for a specified number of cycles, in order to test its behaviour over a period of time.

12.3.2.2 *Apparatus*

An automatic machine for reciprocating the nozzle at a rate of (15_{-1}^{0}) backwards and forwards motions per minute.

A cold water supply circuit (15 °C to 30 °C) with a pump or a similar device supplying the static pressure required.

A load concentrated at the nozzle outlet of:

— 1 kg 1 kg $_{-10}^{0}$ if the projection of the nozzle is less than or equal to 200 mm (see dimension D in Table 3);

— a load giving a bending moment of $2_{-0,2}^{0}$ N·m if the projection of the nozzle is greater than 200 mm.

12.3.2.3 *Procedure*

Mount the mixing valve on the machine and connect it to the supply circuit. If the nozzle has a flow rate regulator, leave it in position and verify there is no obstruction during the test.

From the end of the swivel nozzle, suspend a mass as defined in **12.3.2.2**.

Connect the drive device of the automatic machine to the swivel nozzle.

With the mixer closed, adjust the water pressure in the two supply circuits to a value not greater than 0,1 MPa (1 bar).

With the temperature control device adjust the flow rate between 0,066 l/s and 0,1 l/s, (4 l/min to 6 l/min). This flow adjustment shall be made by means of the independently operating on/off control device or in the absence of the device by partially obstructing the outlet.

Subject the swivel nozzle to a test of 80 000 cycles, each cycle comprising a reciprocating movement through an arc of around 110° or, if there is a stop, over 90 % of the theoretical travel.

During the test, move the nozzle smoothly at as steady a speed as possible at a rate of 15_{-1}^{0} backwards and forwards motions per minute.

12.3.3 ***Requirement***

During the test, there shall be no deformation, fracture of the swivel nozzle or the device connecting it to the body or any leakage of the assembly.

At the end of the test, leaktightness shall be verified in accordance with the specifications of **9.5**.

13 Torsion resistance characteristics of the control

13.1 General

The test described is a type test (laboratory test) and not a quality control test carried out during manufacture.

This test shall be carried out on different samples to those that have undergone the mechanical endurance test (see **12.1**).

This clause specifies a test method for verfying the resistance of the control device to the stresses of opening, closing and pivoting (temperature adjustments) and gives the corresponding specifications.

13.2 Test method

13.2.1 ***Principle***

The principle of the test consists of subjecting the control device, to a given torque in specified directions of operation, in order to verify its strength.

13.2.2 ***Apparatus***

This comprises either a torque wrench (2 % accuracy) which is adapted to the control device (crosstop, lever or other) or a lever arm and instrument for measuring the applied force.

Care shall be taken to ensure that eccentric forces do not occur.

13.2.3 ***Procedure***

The mixing valve, fitted with its control device, shall not be supplied with water during the test.

The test is carried out at ambient temperature.

— flow rate control.

This test does not apply to mechanical mixing valves with rate controls without fixed thrust (diverting flow control type).

Gradually apply over 4 s to 6 s and maintain for 5 min a torque of (6 ± 0,6) N·m to the end of the flow control device in the closing direction of travel and in the mid blend position:

— temperature control.

Gradually apply over 4 s to 6 s and maintain for 5 min a torque of $3_{-0,5}^{0}$ N·m to the end of the temperature control device both in the direction of cold water and separately in the direction of hot water.

This test is carried out on the temperature control device once with the flow control device in the open position and once in the closed position.

13.2.4 ***Requirements***

After the test, there shall be no visible deformation on any component or any deterioration in operation with regard to leaktightness, flow rate and sensitivity.

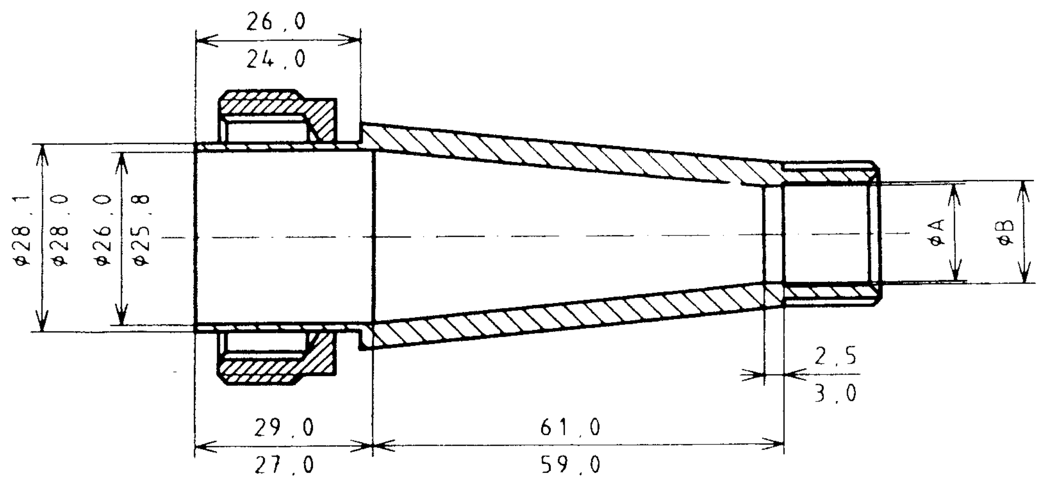
After inspection, leaktightness, flow rate and sensitivity requirements are tested in accordance with **9.3**, **9.4**, **9.5**, **10.5** and **10.6**.

14 Protection against pollution of drinking water

A mixing valve fitted with a flexible outlet hose shall be equipped with an anti-pollution device in accordance with prEN 1717 (under preparation by CEN/TC 164/WG 4).

Annex A (normative)
Design of reducing adapters

Dimensions in millimetres



End to prEN 1254-2
Type A (Size as recommended)

Figure A.1 — Reducing adapter

Table A.1 — Dimensions of reducing adapters (for use with test apparatus shown in Figure 15)

Tube size mm	∅ A ± 0,2 mm	∅ B + 0,2 mm	X° ref
10	8,8	10,2	16
15	13,5	15,2	12
22	20,2	22,2	6
28	Adapter not required		

Annex B (normative)
Examples of pressure take-off tees

B.1 Recommendation for the design of pressure take-off tees

Figure B.1 shows three examples of pressure take-off tees giving equivalent results:

— individual types: A and B;

— annular slit type: C.

Requirements relating to the design and manufacture of pressure take-off tees are given in ISO 5167-1:1991.

The main principles are:

B.1.1 *Individual type*

— The axis of the pressure orifices shall intersect the axis of the piping (or casing) and be perpendicular to it.

— The opening of the orifice shall be circular and the edges flush with the wall of the piping (or the casing). Slight rounding at entry is permitted (radius 1/10 diameter of the pressure orifice).

— The diameter of the pressure orifice shall be less than 0,1*D* (*D*: internal diameter of the tube or casing).

— There shall be an even number (at least four) of the pressure orifices. The angles formed by the arcs of the pressure orifices shall be approximately equal.

— The area of the free cross-section of the annular chamber of the casing shall be greater than or equal to half the total area of the orifices connecting the chamber to the piping.

B.1.2 *Annular slit*

— The thickness *f* of the annular shall be equal to or greater than twice the width *i* of the slit.

— The area of the free section of the annular chamber should be equal to or greater than half the total area of the annular slit connecting the chamber to the piping.

— All surfaces coming into contact with the fluid measured shall be clean and well finished.

— The width *i* of the annular slit should be nominally 1 mm.

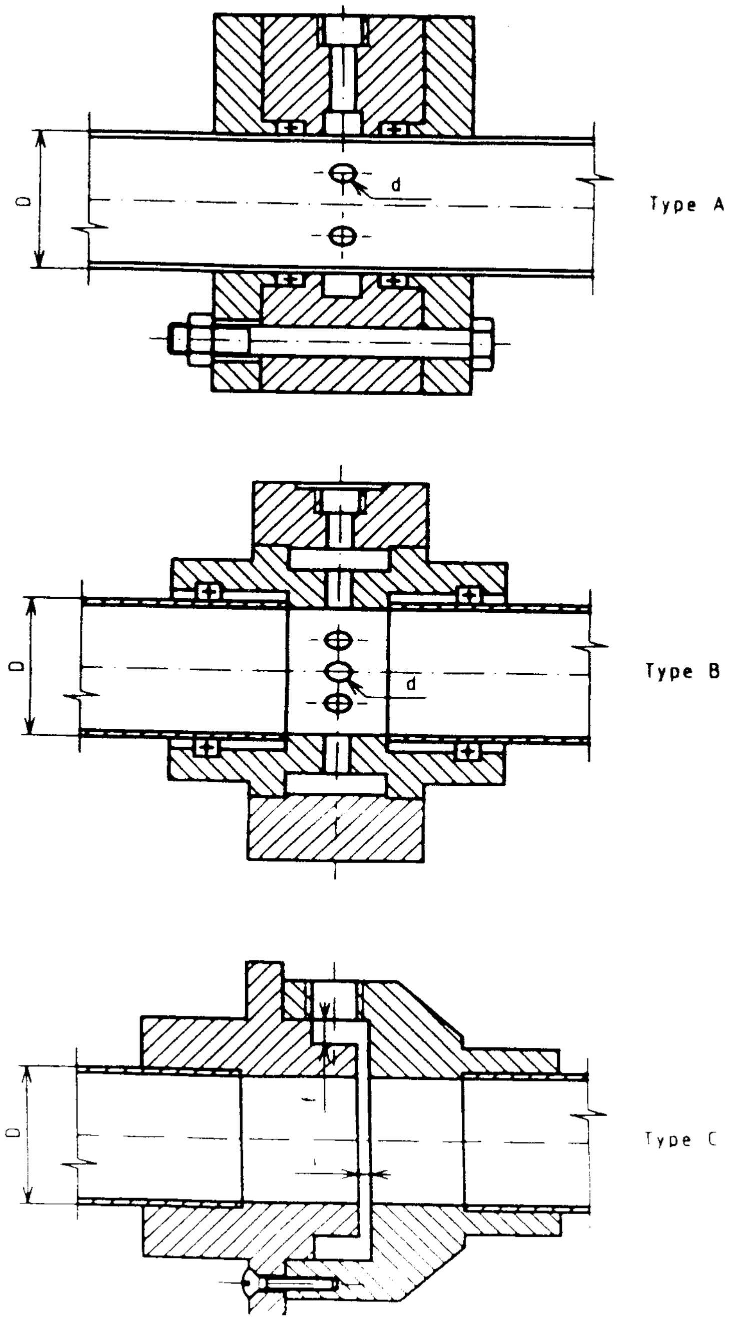


Figure B.1 — Examples of pressure take-off tees

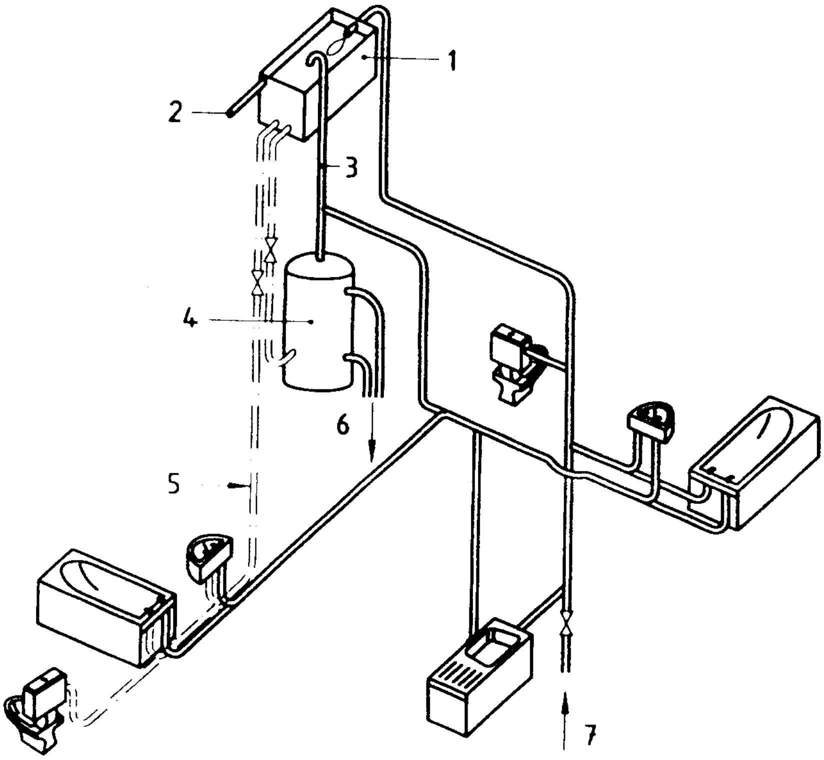
Annex C (informative)

Low hydraulic resistance fittings

In certain geographical locations of the world, installations exist which are cistern fed or have to accommodate very low water pressures. The common minimum pressure level for cistern fed systems is 0,01 MPa (0,1 bar) and because of the flow rate requirement demanded by the end user necessitates "low hydraulic resistance" fittings.

"Low hydraulic resistance" fittings are designed specifically to provide adequate flow rate from low pressure supplies and in all other aspects such as strength, structural integrity, safety, etc., have to meet the same stringent requirement as high pressure fittings.

See Figure C.1 for typical cistern fed water system.



Key

1 Cold water storage cistern
2 Warning pipe
3 Vent pipe
4 Hot water cylinder
5 Alternative cistern fed cold supply to sanitary appliances
6 To boiler
7 Mains supply pipe (supply pressures up to 10 bar)

Figure C.1 — Traditional UK vented domestic hot water and cold mains water supply system

Annex D (informative)
Summary of leaktightness tests

Table D.1 — Summary of leaktightness tests

Leaktightness		Connection to test circuit	Position of obturator or diverter	Outlet orifice	Position of temperature control	Test pressure	Duration	Requirements	
Mechanical mixers and obturator	Mixer upstream of obturator and of obturator	Both inlets	Closed	Open	Full operating range	(1,6 ± 0,05) MPa (16 ± 0,5) bar static pressure	(60 ± 5) s	No leakage through walls or at obturator	
	Obturator cross flow	Single inlet, one side then other	Closed	Open	Full operating range	(0,4 ± 0,02) MPa (4 ± 0,2) bar static pressure	(60 ± 5) s	No leakage at outlet orifice or unconnected inlet	
	Mixer downstream of obturator	Both inlets	Open	Closed	Full operating range	(0,4 ± 0,02) MPa (4 ± 0,2) bar (0,02 ± 0,005) MPa (0,2 ± 0,05) bar static pressure	(60 ± 5) s (60 ± 5) s	No leaking	
Manual diverter	Shower outlet	Both inlets	Obturators open diverter to bath	Bath outlet closed artificially shower outlet open		(0,2 ± 0,02) MPa (2± 0,2) bar (0,02 ± 0,005) MPa (0,2 ± 0,05) bar static pressure	(60 ± 5) s (60 ± 5) s	No leakage at shower outlet	
	Bath outlet	Both inlets	Obturators open diverter to shower	Shower outlet closed artificially		(0,2 ± 0,02) MPa (2 ± 0,2) bar (0,02 ± 0,005) MPa (0,2 ± 0,05) bar static pressure	(60 ± 5) s (60 ± 5) s	No leakage at bath outlet	

Table D.1 — Summary of leaktightness tests *(continued)*

Leaktightness		Connection to test circuit	Position of obturator or diverter	Outlet orifice	Position of temperature control	Test pressure	Duration	Requirements	
Diverter with automatic return	Shower outlet	Both inlets	Obturators open diverter to bath	Both outlets open		(0,08 ± 0,004) MPa (0,8 ± 0,04) bar dynamic pressure	(60 ± 5) s	No leakage at shower outlet	1) No dislodged diverter
	Bath outlet	Both inlets	Obturators open diverter to shower	Both outlets open		(0,08 ± 0,004) MPa (0,8 ± 0,04) bar dynamic pressure	(60 ± 5) s	No leakage at bath outlet	2) Shut water off 3) Automatic return of diverter in bath position fast closing water position
	Bath outlet (1) (2) (3)	Both inlets	Obturators open diverter to shower	Both outlets open		(0,02 ± 0,001) MPa (0,2 ± 0,01) bar dynamic pressure	(60 ± 5) s	No leakage at bath outlet	
	Shower outlet	Both inlets	Obturators open diverter to bath	Both outlets open		(0,02 ± 0,001) MPa (0,2 ± 0,01) bar dynamic pressure	(60 ± 5) s	No leakage at shower outlet	

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