BRITISH STANDARD

BS 2767:1991
Incorporating Amendment No. 1

Specification for

Manually operated copper alloy valves for radiators

ICS 91.140.10

Confirmed November 2008

Committees responsible for this British Standard

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BEAMA Ltd. [Association of Control Manufacturers (TACMA)]
British Gas plc
British Plumbing Fittings Manufacturers' Association
British Valve and Actuator Manufacturers' Association
Building Services Research and Information Association
Department of the Environment (Property Services Agency)
Heating and Ventilating Contractors' Association
Hevac Association
Institute of Domestic Heating Engineers
Institute of Refrigeration
Institution of Gas Engineers
Society of British Gas Industries

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Contents

Foreword

This revision of BS 2767 has been prepared under the direction of the Refrigeration, Heating and Air Conditioning Standards Policy Committee and supersedes BS 2767:1972 which is withdrawn. It takes into account developments in manufacture and testing of radiator valves, and latitude is allowed for variation in design of these valves.

The principal changes in this revision are as follows.

a) The title includes the words “manually operated” to indicate exclusion of thermostatic radiator valves which are covered in BS 6284.

b) Pressure and temperature ratings are unchanged but guidance is given where compression or capillary ends in accordance with BS 864-2 are used.

c) A test for the torque strength of the handwheel is included.

d) Unions have been omitted owing to the decrease in their use.

e) A test for the torque strength of the union nut is included.

f) The 1¼ size valve has been deleted owing to diminished use, but connections for 8 mm, 10 mm and 12 mm copper tube are now included.

g) Compression type tailpiece connections are included (see Figure 1).

h) Tests are divided into type tests and routine tests.

i) The grade of chromium plating is specified.

j) A new method of defining minimum flow area is given that aligns with BS 864-2.

k) Provisions have been made for a draining facility to be incorporated in the valve body or tailpiece.

l) Tests for rubber stem seals have now been related to valve types.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 13 and a back cover.

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1 Scope

This British Standard specifies materials, essential aspects of design, and performance requirements for manually operated copper alloy valves for connection to hot water radiators.

Two types of valve are specified on the basis of their pressure ratings; type 4 with a maximum working pressure of 4 bar[1)] and type 10 with a maximum working pressure of 10 bar.

The range of sizes covered is suitable for use with radiators having ½ in, ¾ in, or 1 in female threaded connections in accordance with BS 21.

End connections for connection to the valve of 8, 10, 12, 15, 22 and 28 mm copper tube, and threads for ½, ¾ and 1 in threaded iron pipe are included.

The standard also covers valves with tailpieces, including tailpieces which incorporate a draining facility or an auxiliary valve.

NOTE 1 All pressures given are gauge pressures.

NOTE 2 Figure 1, Figure 2 and Figure 3 are solely for the purpose of showing alternative types, part names and, collectively, some typical variations of detail; they are not intended to influence design.

NOTE 3 Information to be supplied by the purchaser and requirements to be agreed between supplier and purchaser are given in Appendix A.

NOTE 4 The publications referred to in this Standard are listed on the inside back cover.

2 Definitions

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

2.1
manually operated valve
a valve controlling the flow of water to or from a radiator to which it is fitted

the flow is set by the operation of a handwheel or loose key

2.2
handwheel valve
a valve fitted with a handwheel to control the flow of water

2.3
lockshield valve
a valve, fitted with a lockshield, which, after having been set to a desired flow, cannot be altered except by use of a special key or the removal of the lockshield

2.4
draining facility
a facility incorporated in a valve by which an individual radiator can be drained

NOTE The radiator is drained by closing the valves and opening the draining facility.

2.5
auxiliary valve
an additional valve incorporated within the tailpiece to enable the radiator to be removed without draining

3 Designation of valves by size

The size by which the valves are designated shall be the nominal diameter of the tube or pipe with which the valves are to be used. For example:

a) for an 8 mm copper tube the designation shall be 8;

b) for a ½ in threaded pipe the designation shall be ½.

[1)] 1 bar = 10^5 N/m^2 = 10^5 Pa.

4 Pressure and temperature ratings

The pressure and temperature ratings for the two types of valve shall be as follows.

a) Type 4 valves shall have a maximum service temperature of 95 °C and a maximum working pressure of 4 bar.

b) Type 10 valves shall have a maximum service temperature of 120 °C and a maximum working pressure of 10 bar.

NOTE Where type 10 valves having inlet and outlet connections for compression and capillary fittings are intended to be used, reference should be made to Table 5 of BS 864-2:1983.

The stem seals shall comply with **7.3**.

5 Marking

Valves shall be permanently and legibly marked with the following:

a) the manufacturer's name or mark;

b) the number of this British Standard, i.e. BS 2767[2)], followed by the type of valve, i.e. 4 or 10.

NOTE 1 The marks may be applied to any convenient external part of the valve.

NOTE 2 Additional marking is not precluded.

6 Materials and manufacture

6.1 The materials used in the manufacture of the component parts of the valves shall be as given in Table 1.

6.2 Materials shall be free from defects, such as cracking, laminations, voids and inclusions. Castings shall not be burned, plugged, stopped or patched. All surfaces shall be free from burrs.

6.3 Plastics handwheels shall comply with **8.2**.

[2)] Marking BS 2767 on or in relation to a product represents a manufacturer's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

Table 1 — Materials

	Gunmetal or brass for sandblasting	Brass for diecasting	Brass forging stock	Brass not forging stock	Plastics	Phosphor bronze	Rubber[b]	Graphite impregnated fibre or PTFE[c]
	BS 1400[a] LG2, SCB1 or SCB3	BS 1400[a] DCB3 or PCB1	BS 2872[a] CZ 122 or CZ 132	BS 2874[a] CZ 121 or CZ 132		BS 2870[a] PB 102		
Body	×	×	×					
Bonnet and stuffing box	×	×	×	×				
Stem				×				
Disc				×				
Wedge	×	×	×	×				
Tailpiece	×	×	×	×				
Union nut	×	×	×	×				
Gland			×	×				
Gland nut			×	×				
Gland screw			×	×				
Lockshield			×	×	×			
Handwheel					×			
Combined handwheel and shield					×			
Stem seal:								
bellows type						×		
"O" ring							×	
one piece							×	×

[a] Copper alloys complying with these standards are preferred. Other copper alloys are acceptable provided they have the same minimum physical properties.
[b] Test requirements for rubber stem seals are given in Table 4.
[c] Polytetrafluoroethylene.

7 Design and construction

7.1 General

7.1.1 Valves shall have one end supplied with a tailpiece for connection to the radiator. The other end shall be in the form of a compression or capillary joint or shall have a female pipe thread.

NOTE 1 The tailpiece may include an auxiliary valve or draining facility.

NOTE 2 Examples of three designs of valves are shown in Figure 1, Figure 2 and Figure 3. An alternative tailpiece incorporating an auxiliary valve is shown in Figure 4.

7.1.2 Valves (including the draining facility where incorporated) shall be capable of withstanding the appropriate hydrostatic test pressure specified in clause **8** without showing permanent distortion.

7.1.3 The minimum flow area through valves and tailpieces shall be not less than the area of a circle of the diameter given in Table 2. This shall not apply to any draining facility on the valve body or tailpiece.

7.1.4 The minimum body and bonnet thickness at any point subject to the internal pressure from the water in the valve shall be not less than the values given in Table 3. If the valve has compression or capillary ends the wall thickness at this point shall comply with BS 864-2.

7.1.5 The minimum thickness of the ends of valves having female pipe threads shall be not less than the values given in Table 3.

Table 2 — Minimum flow area through valve and tailpiece

Size designation		Diameter of circle corresponding to minimum flow area
Threaded (BS 21)	Capillary/compression mm	mm
	8	6.0
	10	8.0
	12	10.0
½	15	12.0
¾	22	18.0
1	28	24.0

7.1.6 The minimum stem diameters shall be as given in Table 3.

7.1.7 Valves shall be closed by rotating the stem in a clockwise direction viewed from the top of the valve.

7.1.8 Valves shall be supplied:

a) with a natural finish, or chromium plated in accordance with **7.1.9** and **7.1.10**; or

b) with other surface finishes as agreed between purchaser and supplier [see **A.2**a)].

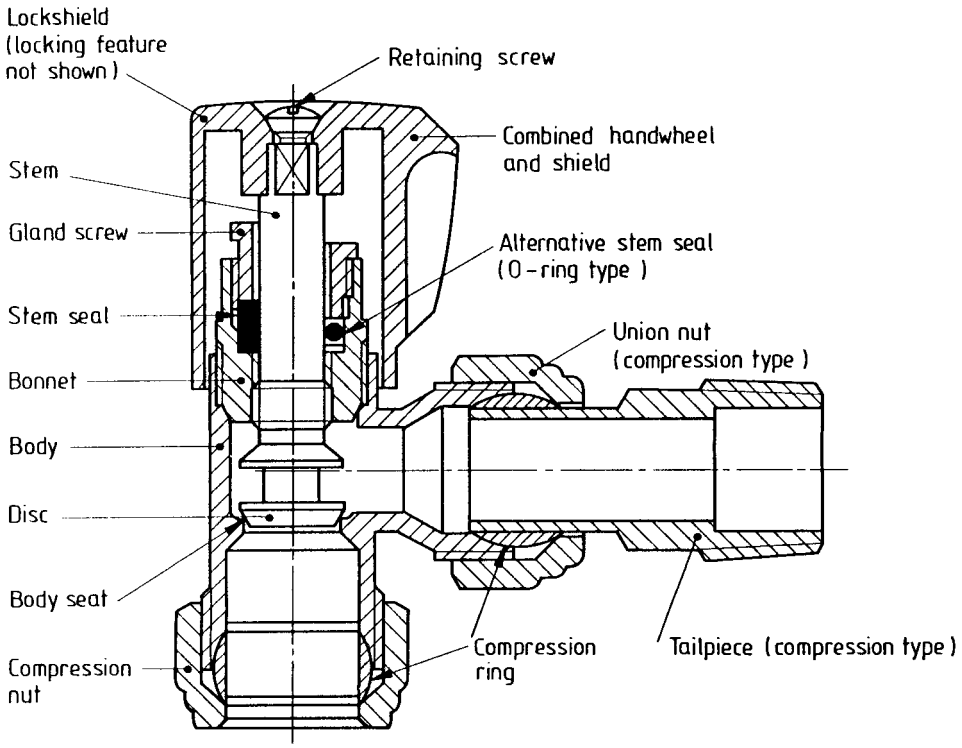

Figure 1 — Typical angle pattern valve

Table 3 — Component dimensions

Size designation		Minimum body and bonnet thickness at any point subject to direct pressure	Minimum thickness at end of valves having a female pipe thread (measured from the basic major diameter of the threads)	Minimum diameter of stem for sealing
Threaded (BS 21)	Capillary/ compression			
mm	mm	mm	mm	mm
½	8 to 15	1.7	2.2	6.5
¾	22	1.8	2.3	7.5
1	28	2.0	2.7	8.5

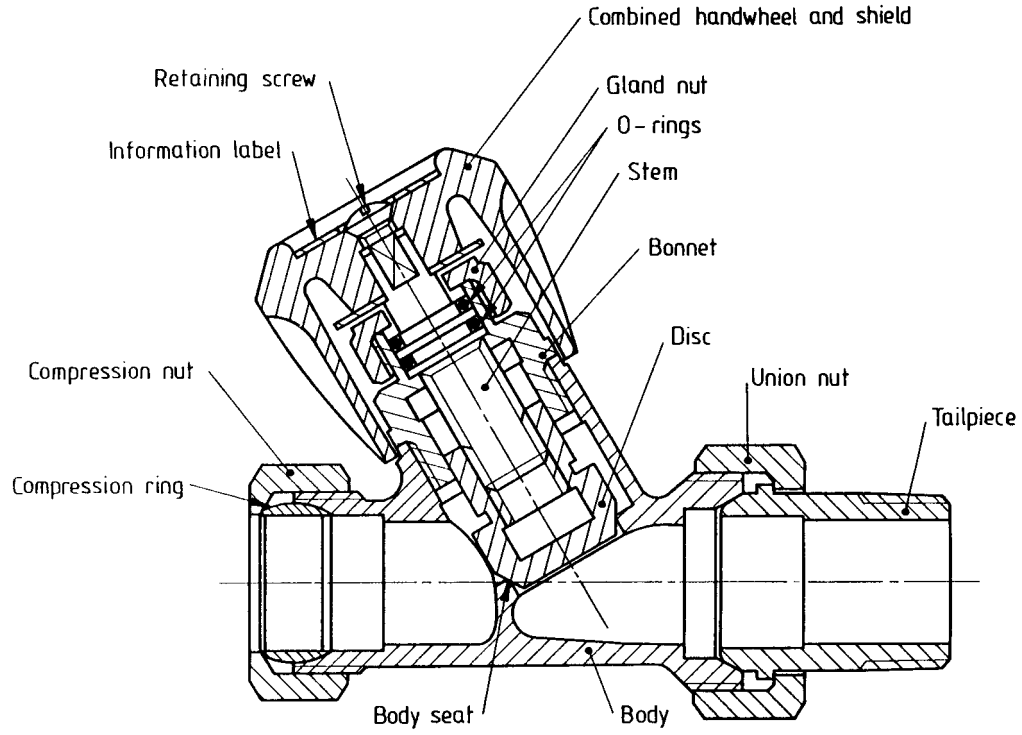

Figure 2 — Typical Y-pattern valve

7.1.9 Nickel plus chromium plating on copper alloys shall comply with BS 1224, service condition 1, classification Cu/Ni 5b Cr r.

7.1.10 Nickel plus chromium plating on plastics material shall comply with BS 4601, service condition 1A, classification PL/Ni 5b Cr r.

7.2 Body connections

7.2.1 *Compression and capillary ends*

Compression and capillary ends shall comply with BS 864-2.

7.2.2 *Threaded ends*

If female threads are used these shall be either tapered or parallel and shall comply with BS 21.

NOTE If the purchaser requires a different thread form this should be stated in the enquiry or order [see **A.1**f)].

Provision shall be made for tightening the union or compression nut, for example by making it hexagonal, octagonal or ribbed.

7.2.3 *Tailpiece connection*

The body end arranged for the tailpiece connection shall have a parallel male thread for the attachment of the union nut and shall have an internal seating to engage the tailpiece.

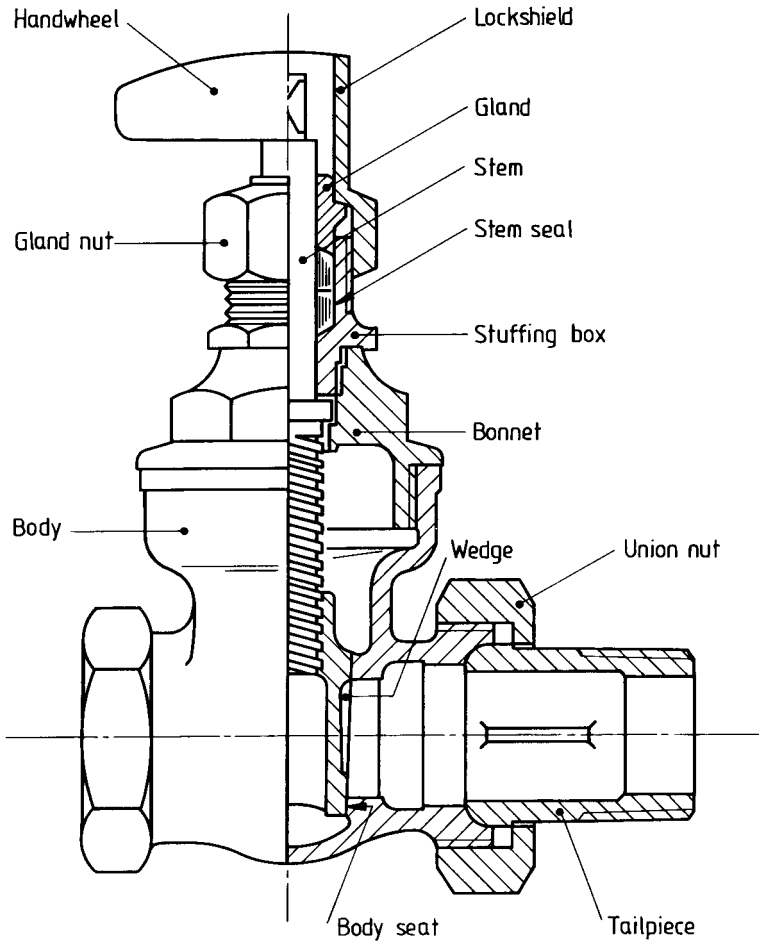

Figure 3 — Typical gate pattern valve

7.3 Stem seal and servicing

The construction of the stems seals shall be a bellows type, a toroidal "O" ring or a one piece packer.

NOTE 1 All stem seals should be suitable for continuous use at the maximum temperature and pressure for the type of valve (see clause **4**).

When tested using the methods specified in Table 4, toroidal "O" rings and rubber one piece packed stem seals shall meet the requirements given in Table 4.

Type 4 valves shall be capable of being serviced without draining down the system or part thereof.

NOTE 2 A small water loss may take place during servicing.

NOTE 3 It is not a requirement of this standard that type 10 valves should be capable of being serviced without draining down the system.

7.4 Discs

Discs either shall be integral with the stem, or shall be attached to the stem in such a manner that they will lift when the valve is opened.

7.5 Handwheel

The handwheel shall be attached to the stem by means of a metal nut or screw and shall either be integral with or separate from any shield.

The direction of opening or closing, or both, shall be legibly marked on the handwheel or on a label attached to the handwheel.

7.6 Tailpiece

7.6.1 The tailpiece shall have one end in the form of a seat to make contact with the valve body. This shall be in the form of a compression joint in accordance with BS 864-2 (see Figure 1) or a spherical design (see Figure 2 and Figure 3).

The end for connection to the radiator shall have a tapered male thread complying with BS 21 or Figure 2 and Table 6 of BS 864-2:1983, or for radiators produced with the inlet and outlet tappings suitable for a parallel male thread, the male thread of the tailpiece shall be in accordance with Appendix C of BS 21:1985.

Table 4 — Test requirements for rubber stem seals

Test number	Test	Unit	Requirements		Method of test
			Valve type 4	Valve type 10	
1	Hardness	IRHD	70 ± 5	70 ± 5	BS 903-A26
2	Tensile strength	MPa	5 min.	10 min.	BS 903-A2
3	Elongation at break	%	150 min.	150 min.	BS 903-A2
4	Compression set 168 h at 100 °C	%	15	15	BS 903-A6 Method A. Type 1 test piece 25 % compression
5	Ageing in air 72 h at 150 °C				BS 903-A19
	a) Tensile strength	% change	–25 max.	–25 max.	BS 903-A2
	b) Elongation at break	% change	–30 max.	–30 max.	BS 903-A2
	c) Hardness	Change in IRHD	0 to +5	0 to +5	BS 903-A26
6	Effect of distilled water 168 h at 100 °C				
	a) Volume	% change	0 to +5	0 to +5	BS 903-A16
	b) Hardness	Change in IRHD	0 to +5	0 to +5	BS 903-A26
7	Effect of lubricant 72 h at 100 °C				
	a) Volume	% change	0 to + 7.5	±1	BS 903-A16
	b) Hardness	Change in IRHD	±5	±2	BS 903-A26

7.6.2 The tailpiece shall have means for tightening into the female thread of the radiator.

7.6.3 The design of the tailpiece shall be such that the union nut can be unscrewed to permit removal of the valve to which it is attached, without disturbing the threaded joint end of the tailpiece screwed into the radiator.

7.6.4 Where an auxiliary valve is incorporated into the tailpiece of the valve it shall comply with **8.1.1** and **8.1.3**.

7.7 Draining facility

Where a draining facility is incorporated in either the body or tailpiece of the valve it shall comply with **8.1.1**.

8 Type tests

8.1 Hydrostatic tests at ambient temperature

8.1.1 *Body test including tailpiece*

With the valve in the open position, the auxiliary valve, where fitted, also in the open position, and the draining facility, where incorporated, in the closed position, there shall be no leakage of water from the interior of the valve(s) when the body and tailpiece are subjected to a hydrostatic pressure of 1.5 times the maximum pressure rating of the valve for a period of 60 s.

8.1.2 *Seat test*

When the valve is closed using the standard handwheel and when pressure is applied:

a) for gate pattern valves, successively to each side of the seat; or

b) for angle and Y-pattern valves, under the disc with the other side open to the atmosphere;

there shall be no leakage of water through the seat when subjected to 1.1 times the maximum pressure rating of the valve for a period of 60 s.

8.1.3 *Auxiliary valve seat test*

There shall be no leakage of water past the auxiliary valve in the closed position when subjected to a hydrostatic pressure of 1.5 times the maximum pressure rating of the valve, applied at the end of the tailpiece to which the connection to the radiator is to be made, for a period of 60 s.

NOTE This test may be conducted on the tailpiece alone where necessary.

8.2 Handwheel torque test

When tested as described in Appendix B, the handwheel shall be capable of withstanding the applied torque without affecting the efficiency of the valve.

NOTE Some damage to the handwheel is tolerated, e.g. bruising of the components or damage affecting the fit of the handwheel to the spindle.

8.3 Union nut torque test

When tested as described in Appendix C, the union nut, assembled, with a tailpiece, to a valve shall be capable of withstanding the applied torque without affecting the efficiency of the valve.

NOTE Some damage to the union nut is tolerated, e.g. bruising.

9 Routine pressure tests

9.1 General

Every valve, with or without the tailpiece assembled, shall be tested in accordance with either:

a) **9.2** or **9.3**, or other test methods of demonstrated equivalence; or

b) other test methods as agreed between purchaser and supplier [see **A.2**b)].

Where the tailpiece includes an auxiliary valve the tests specified in **9.2** or **9.3** shall be carried out with the tailpiece fitted to the valve. The auxiliary valve shall be in the open position during these tests.

9.2 Hydrostatic test

9.2.1 *Angle or Y-pattern valves*

With the valve in the closed position and the pressure applied above the seat, there shall be no leakage of water from the valve assembly when subjected to a minimum hydrostatic pressure of 1.5 times the maximum pressure rating of the valve for 5 s.

9.2.2 *Gate valves*

9.2.2.1 *Body test*

With the valve in the open position with one end closed to the atmosphere, there shall be no leakage of water from the valve assembly when subjected to a minimum hydrostatic pressure of 1.5 times the maximum pressure rating of the valve for 5 s.

9.2.2.2 *Seat test*

With the valve in the closed position and the pressure applied to the side of the wedge furthest from the tailpiece end, and with the tailpiece end open to the atmosphere, there shall be no leakage of water through the seat when subjected to a minimum hydrostatic pressure of 1.1 times the maximum pressure rating of the valve for 5 s.

9.3 Pneumatic test

9.3.1 ***Angle or Y-pattern valves***

With the valve in the closed position and the pressure applied above the seat, there shall be no leakage of air from the valve assembly when subjected to a minimum pneumatic pressure of 4 bar for 5 s.

9.3.2 ***Gate valves***

9.3.2.1 *Body test*

With the valve in the open position with one end of the assembly closed to the atmosphere, there shall be no leakage of air from the valve when subjected to a minimum pneumatic pressure of 4 bar for 5 s.

9.3.2.2 *Seat test*

With the valve in the closed position and the pressure applied to the side of the wedge furthest from the tailpiece end, and with the tailpiece end open to the atmosphere, there shall be no leakage of air through the seat when subjected to a minimum pneumatic pressure of 4 bar for 5 s.

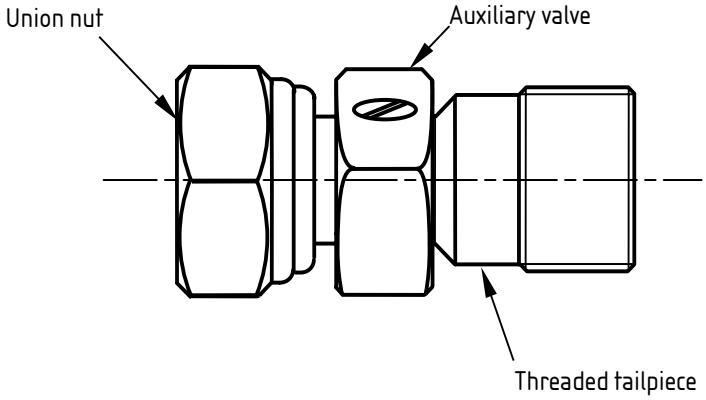

Figure 4 — Tailpiece incorporating an auxiliary valve

Appendix A
Information to be supplied and requirements to be agreed

A.1 Information to be supplied by the purchaser

The following information should be provided by the purchaser when making an enquiry or placing an order.

a) Nominal size of valve (see clause **3**).

b) Whether a handwheel or lockshield valve is required (see **2.2** and **2.3**).

c) The surface finish required, i.e. natural, chromium plated or other finish [see **7.1.8** and **A.2**a)].

d) Type of valve, i.e. type 4 or type 10 (see clause **4**).

e) Types of end connection for copper tube.

f) Types of thread for threaded iron pipe.

g) Whether a draining facility or auxiliary valve is required.

A.2 Requirements to be agreed between supplier and purchaser

The following should be agreed between the supplier and the purchaser.

a) Surface finish if other than natural or chromium plated (see **7.1.8**).

b) Method of routine pressure testing if other than as specified in **9.1**a).

Appendix B
Method of testing the torque strength of the handwheel when assembled to the valve

B.1 Apparatus

B.1.1 *Operating lever,* which fits snugly onto the handwheel, as shown in Figure 5.

B.2 Procedure

Allow water to flow through the valve at the maximum working temperature of the valve for 20 min to allow thermal equilibrium to be reached. Then close the valve and apply a force to the operating lever for 30 s, for example by attaching weights, sufficient to produce the torque indicated in Table 5 for the size of valve being tested, taking into account the weight of the operating lever.

Table 5 — Torque values for testing the handwheel when assembled to the valve

Size designation		Torque
Threaded (BS 21)	Capillary/compression mm	 N·m
½	8 to 15	3.0
¾	22	4.5
1	28	5.5

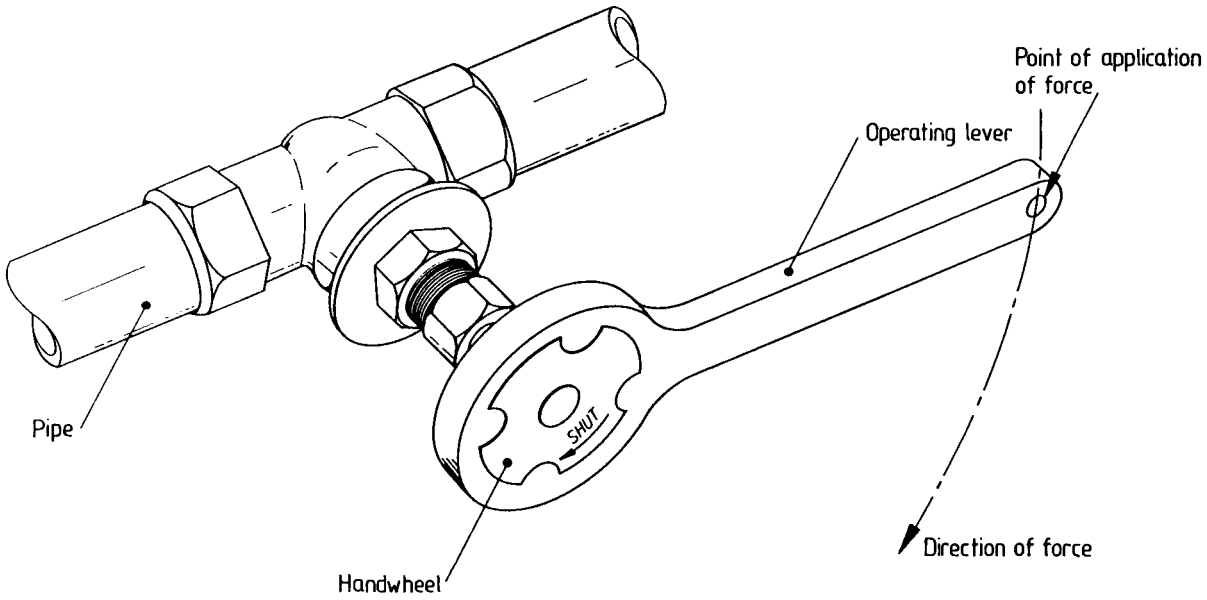

Figure 5 — Arrangement for testing the resistance of the handwheel to torque

Appendix C
Method of testing the torque strength of the union nut

With the valve held rigidly, apply a torque to the union nut as indicated in Table 6 for the size of valve being tested.

Table 6 — Torque values for testing the union nut

Size designation		Torque
Threaded (BS 21)	Capillary/compression mm	N·m
½	15	40
¾	22	60
1	28	80

Publication(s) referred to

BS 21, *Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).*

BS 864, *Capillary and compression tube fittings of copper and copper alloy.*

BS 864-2, *Specification for capillary and compression fittings for copper tubes.*

BS 903, *Methods for testing vulcanized rubber.*

BS 903-A2, *Determination of tensile stress-strain properties.*

BS 903-A6, *Determination of compression set after constant strain.*

BS 903-A16, *Determination of the effect of liquids.*

BS 903-A19, *Heat resistance and accelerated air ageing tests.*

BS 903-A26, *Determination of hardness.*

BS 1224, *Specification for electroplated coatings of nickel and chromium.*

BS 1400, *Specification for copper alloy ingots and copper alloy and high conductivity copper castings.*

BS 2870, *Specification for rolled copper and copper alloys: sheet, strip and foil.*

BS 2872, *Specification for copper and copper alloy forging stock and forgings.*

BS 2874, *Specification for copper and copper alloy rods and sections (other than forging stock).*

BS 4601, *Specification for electroplated coatings of nickel plus chromium on plastics materials.*

BS 6284[3)], *Specification for thermostatic radiator valves.*

[3)] Referred to in the foreword only.

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