भारतीय मानक
Indian Standard

IS 8931 : 2021

जल सेवाओं के लिए तांबा मिश्रधातु के एकल नल, संयोजित नल सम्मुचय, स्टॉप वाल्व एवं एकल लीवर मिक्सर — विशिष्टि

(दूसरा पुनरीक्षण)

Copper Alloy Single Taps, Combination Tap Assemblies, Stop Valves and Single Lever Mixers for Water Services — Specification

(Second Revision)

ICS 91.140.70

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Sanitary Appliances and Water Fittings Sectional Committee had been approved by the Civil Engineering Divisional Council.

This standard was first formulated in 1978 and subsequently revised in 1993. Pillar taps, bib taps and stop valves are extensively used as water fittings for domestic water supplies. Bib taps and stop valves, and pillar taps were earlier covered separately in IS 8931 and IS 8934, respectively. Since the functional requirements of taps and valves were identical, it was decided by the Committee to merge these two standards in IS 8931. In the first revision of IS 8931 in 1993, besides merging the above two standards, the standard also incorporated provisions for combination tap assembly. Further, only the critical dimensions were given in the standard so that the design flexibilities as may be required by the manufacturer could be incorporated. Also, material specifications for various components/parts of taps and valves were elaborated. Since the taps of nominal size of 10, 20 and 25 mm and valves of 10 and 25 mm were not commonly used, these were withdrawn, and some additional performance tests were included in the first revision of the standard.

This second revision of the standard has been brought out to incorporate technological advancements made in the field of manufacturing and use of single taps, stop valves, combination tap assemblies and to include single lever mixers. In this revision of the standard, the following major modifications have been incorporated:

a) Single lever mixers including concealed mixers and diverters have been included.

b) Use of leaded tin bronze material (LTB 2) as a material for these products has been deleted considering that the material is not being used in view of its high lead content.

c) Stainless steel and Arcylonitrile-butadiene-styrene (ABS) material have been included for flanges, diverters and diverter components.

d) Neoprene rubber has been included for ‘O’ rings for durability and better performance.

e) Requirement for maximum height of tightening for pillar mounted combination tap assembly has been removed.

f) Some dimensions have been changed considering the current practices of manufacturing and installation.

g) Requirements for accessible taps and guidelines relating to accessibility for person with disabilities have been included.

h) Mechanical endurance characteristic test for taps and valves has been included.

j) Additional requirements for water efficiency rating and labelling of taps, stop valves, combination tap assemblies and single lever mixers have been incorporated through reference to the concerned Indian Standard.

Requirements of screw down rising spindle bib taps, stop valves and pillar taps have been covered in IS 781 : 1984 ‘Specification for cast copper alloy screw down bib taps and stop valves for water services (*third revision*)’ and IS 1795 : 1982 ‘Specification for pillar taps for water supply purposes (*second revision*)’, respectively.

Sensor taps having various requirements for the electronic components as also actuation device, are being covered in a separate standard. Push taps are also being covered separately.

In the formulation of this standard, assistance has also been derived from BS EN 200:2008 ‘Sanitary tapware — Single taps and combination taps for water supply systems of type 1 and type 2 — General technical specification’.

The composition of the Committee responsible for the formulation of this standard is given in Annex G.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

COPPER ALLOY SINGLE TAPS, COMBINATION TAP ASSEMBLIES, STOP VALVES AND SINGLE LEVER MIXERS FOR WATER SERVICES — SPECIFICATION

(Second Revision)

1 SCOPE

This standard lays down the requirements regarding materials, manufacture, workmanship, construction, dimensions, finish and testing of nickel-chromium plated copper alloy non-rising spindle type single pillar and bib taps, combination tap assemblies, stop valves and single lever mixers suitable for operation from 0.05 MPa to 0.5 MPa pressure at maximum temperature of 65 °C.

2 REFERENCES

The standards given in Annex A contain provisions, which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 10446 shall apply, in addition to the following.

3.1 Combination Tap Assembly

3.1.1 *Pillar Mounted Combination* — The tap assembly with a vertical inlet and a nozzle arranged to discharge in a downward direction (such as single hole and three-hole combination tap assemblies for wash basin),suitable for mounting on a horizontal surface.

3.1.2 *Wall Mounted Combination* — The tap assembly with a horizontal inlet and a nozzle arranged to discharge in a downward direction (such as bath and sink combination tap assemblies), suitable for mounting on vertical surface.

3.2 Angle Stop Valve — A valve with the inlet and outlet at right angles to each other and is intended to facilitate servicing of water fittings or appliances.

3.3 Single Lever Mixer — Mixing valve which mixes hot and cold water and which, by means of a control device, allows the user to adjust between ‘all cold water’ and ‘all hot water’, which implies the flow rate of the mixture obtained may be adjusted between ‘no flow’ and ‘maximum flow’ using the same control/operational device (lever/handle).

4 CLASSIFICATION AND NOMINAL SIZES

The nominal size shall be designated by the nominal bore of the pipe outlet to which the taps and valves are normally fitted. The nominal size shall be as follows for each of the type of the product as per this standard:

Sl No.	*Types of Tap*	*Nominal Size*
(1)	(2)	(3)
i)	Pillar tap	15 mm
ii)	Bib tap	15 mm
iii)	Combination tap assembly	15 mm
	a) Wall mounted combination tap assembly	
	b) Pillar mounted combination tap assembly	
iv)	Stop valve	15 mm and 20 mm
v)	Angle stop valve	15 mm and 20 mm
vi)	Single lever mixer	15 mm
	a) Single lever concealed bath and shower mixer with diverter	
	b) Single lever pillar mounted sink mixer with swivel spout	
	c) Single lever pillar mounted basin mixer	
	d) Single lever wall mounted sink mixer with swivel spout	
	e) Single lever bath and shower mixer	

5 MATERIAL

Material, used for different components/parts of taps, stop valves and mixers shall be in accordance with Table 1, except for cartridges for single lever mixers.

Table 1 Material for Components/Parts of Single Taps, Combination Tap Assemblies, Stop Valves and Mixers

(*Clauses* 5, 6.11.1, 6.11.2 *and* 7.1.3.4)

All dimensions in millimetres.

Sl No.	Component	Material	Conforming to
(1)	(2)	(3)	(4)
i)	Body, body components, inlet tubes, nozzle, bonnet and back nuts	a) Cast brass	Grade LCB 2 of IS 292
		b) Die cast brass[1)]	Grade DCB2 of IS 1264
		c) Forged brass	Grade FLB of IS 6912
		d) Brass rods	Grade 1 Half hard of IS 319
		e) Brass tubes	IS 407
		f) Copper Tubes	Soft, annealed IS 10773
ii)	Flanges, diverter and diverter components	a) Cast brass	Grade LCB 2 of IS 292
		b) Die cast brass[1)]	Grade DCB2 of IS 1264
		c) Forged brass	Grade FLB of IS 6912
		d) Brass rods	Grade 1 Half hard of IS 319
		e) Brass sheet	Grade CuZn 37 of IS 410
		f) Stainless steel sheet	Grade 304 of IS 6911
		g) Acrylonitrile butadiene styrene (ABS)	–
iii)	Spindle, glands, washer plate, nuts, screws and pin	a) Brass rods (Extruded or rolled)	Grade 1 Half hard of IS 319
		b) Forged brass	Grade FLB of IS 6912
iv)	Circlip, wire locks	a) Phosphor bronze sheet	Grade 111 HE of IS 7814
		b) Phosphor bronze wire	IS 7608
		c) Stainless steel	Grade 1 of IS 4454 (Part 4)
v)	'O' ring, gasket and seat washer	a) Synthetic rubber	IS 9975 (Parts 1 and 2)
		b) Neoprene rubber	–
		c) Acrylonitrille butadiene rubber (NBR)	–
		d) Synthetic butadiene rubber (SBR)	–
vi)	Knob, knob components	a) Cast brass	Grade LCB 2 of IS 292
		b) Die cast brass[1)]	Grade DCB2 of IS 1264
		c) Forged brass	Grade FLB of IS 6912
		d) Brass rods	Grade 1 Half hard of IS 319
		e) Zinc base alloys	IS 713
		f) Plastic [Polyacetal, Polypropylene, Acrylonitrile butadiene styrene (ABS), Arcylics-Polymethyl-Methacrylates, Nylon- Polymides]	–

[1)] Conformity only with chemical composition to be complied with.

6 MANUFACTURE, WORKMANSHIP AND CONSTRUCTION

6.1 General

Figures appearing in this standard are illustrative and do not specify design features. However, dimensions as specified shall be complied with.

6.2 Casting shall in all respects be sound and free from defects like laps, blowholes and pitting. External and internal surfaces shall be clean, smooth and free from sand. They shall be neatly dressed and no casting shall be burned, plugged stopped and patched.

6.3 Forging shall be sound without lamination, smooth and well finished.

6.4 Knobs shall be sound and free from cracks, spots and blow holes. However, shrinkage marks appearing due to processing are permissible on internal surface so as to not affect the appearance and performances of the knobs.

6.5 Machining

The body, bonnet, spindle and other parts shall be machined true, so that when assembled, the parts shall be axial parallel and cylindrical, with surface smoothly finished within the limits of dimensions specified for various components.

6.6 Screw Threads

6.6.1 The inlets and outlet connection threads whether internal or external, shall be a pipe thread conforming to either IS 554 or IS 2643. This requirement does not apply to single hole combination tap assembly and single lever mixer.

6.6.2 The length of spindle threads shall be such that when the washer plate is resting on the seating without any washer, a length of thread equal to not less than 50 percent of the external diameter of the threaded portion of the spindle shall be in full engagement with the internal thread of the washer plate.

6.7 Waterway

6.7.1 Except where otherwise specified in this standard, the area of waterway throughout the body of a tap or valve shall not be less than the area of a circle of diameter equal to the minimum bore of seating specified in Table 2.

6.7.2 In any single outlet combination tap assembly the area of waterway through the individual tap shall be as specified in **6.7.1** up to the junction of the two tap outlet with the combined outlet. The internal diameter of a combined outlet shall not be less than 15 mm. If the combined outlet is not circular it shall have an area of waterway not less than the area of a circle of diameter equal to 15 mm.

6.7.3 In a combination tap assembly with diverter for bath and shower, the area of waterway may be reduced below the bore specified in **6.7.1**.

6.7.4 In case of a single lever mixer, the minimum waterway in the whole product shall be have an area not less than the area of a circle of diameter equal to 6.5 mm.

6.8 Flow Straightening and Aerating Device

Taps may be fitted with flow straightening and aerating devices at manufacturer's option.

NOTES

1 Flow straightening of the corrugated sleeve or moulded plastic may be incorporated at the outlet within the nozzle of the tap. It may be noted that straighteners usually reduce the area of waterway.

2 Flow straightening and aerating device which incorporate a multiplicity of small orifices, that is those containing wire gauge or perforated plates, shall be screwed type and be easily removable for cleaning purpose. It should be noted that when aerators are fitted there is usually a reduction in flow.

6.9 Body Seats

6.9.1 The seat may be integral with the body or may be separate renewable seat rings, screwed into body and shall have serations or slots or any other not less efficient device to facilitate renewal. The area through the renewable seat ring shall be at least equal to a circle of diameter equal to the minimum bore of seating specified in Table 2. Seat ring faces shall be finished smooth and edges shall be deburred.

6.9.2 The body shall be machined so that when the body and seat are assembled and secured in position they are co-axial and the faces of seat and body are parallel.

6.10 Bonnet Assembly

The surface forming the body to bonnet joint shall be machined smooth. The joint may be with a gasket or an 'O' ring.

NOTE — For single lever mixers, the term 'operating mechanism' is used in place of 'bonnet assembly'.

6.11 Gland Packing

6.11.1 Except as specified in **6.11.2**, the gland or stuffing box shall be packed with, gland packing as per Sl No. (v) of Table 1, suitable for both cold and hot water. A suitable washer as per Sl No. (v) of Table 1 may also be fitted in the bottom of stuffing box but this may be omitted if the packing is in the form of a moulded composition packing ring.

6.11.2 When 'O' rings are to be employed for the gland seal, a minimum of two 'O' rings as per Sl No. (v) of Table 1 shall be fitted in spindle. They shall be capable of being renewed.

6.12 Flanges

Taps designed for mounting on to flat surfaces may have integral or separate flanges.

6.13 Knob

All knobs shall be close fit on a squared or serrated spindle. The knob may be secured by a screw or using any other efficient device, provided that the minimum cross-sectional area of attachment is not less than the equivalent square for that size of spindle. The knob shall not have any threads so as to screw it directly to the spindle. A non-metallic insert may be provided between knob and the spindle to restrict the heat transfer, when hot water is flowing.

7 DIMENSIONS

7.1 Single Pillar and Bib Tap, Combination Tap Assembly, Stop Valve and Angle Stop Valve

7.1.1 *Minimum Thickness*

Except where a lesser thickness is specified, no point of body subjected to direct water pressure shall have

a thickness less than 2.0 mm. However, in the case of single tap and combination tap assemblies, the open outlet nozzle portion may be reduced to 1.6 mm in case of castings and forging and to 0.6 mm when drawn tubes are used.

7.1.2 *Body*

7.1.2.1 The dimensions of body to bonnet connection and seat shall conform to the dimensions specified in Table 2, read with Fig. 1.

7.1.2.2 The seat edges shall be rounded off to avoid cutting edges.

7.1.2.3 Square or lugs on the shank under the flange of pillar tap known as locating feature is an optional feature. Where provided, it shall not exceed the following dimensions:

a) Circumscribed diameter of locating feature : 29 mm

b) Depth of locating feature under flange : 5 mm

7.1.2.4 Dimensions of bodies of pillar taps and bib taps shall conform to those specified in Table 3 read with Fig. 2, and Table 4 read with Fig. 3, respectively.

7.1.2.5 Dimensions of bodies for stop valves including angle stop valves shall conform to those specified in Table 5 read with Fig. 4.

7.1.2.6 Dimensions of bodies for wall mounted combination tap assembly shall conform to those specified in Table 6 read with Fig. 5. Dimensions of bodies of one-hole and three-hole pillar mounted combination tap assemblies shall conform to those specified in Table 7 read with Fig. 6 and Table 8 read with Fig. 7, respectively.

7.1.3 *Bonnet Assembly*

7.1.3.1 Spindle, bonnet, washer plate and other parts shall be machined true, so that when assembled, the parts shall be axial, parallel and cylindrical with surface smoothly finished.

7.1.3.2 The dimensions of bonnet assembly shall conform to those specified in Table 9 read with Fig. 8.

7.1.3.3 *Washer plate*

7.1.3.3.1 The washer plate shall be shrouded or flat type, made from one piece and shall be machined all over.

7.1.3.3.2 The part of washer plate that prevents turning shall be either two flats, a square, a hexagon or any other shape that prevents turning.

7.1.3.3.3 The seat washer shall be affixed to the washer plate. The connection between the seat washer and its housing shall be ensured by a screw, a nut or any other means that ensures the firm seating of the washer in its place.

7.1.3.3.4 The minimum lift of washer plate with washer in position shall be 3.5 mm and 5.0 mm, respectively for 15 mm and 20 mm nominal bore taps and valves.

7.1.3.4 The seat washer shall be as per Sl No. (v) of Table 1 and should be suitable for heat resistant applications.

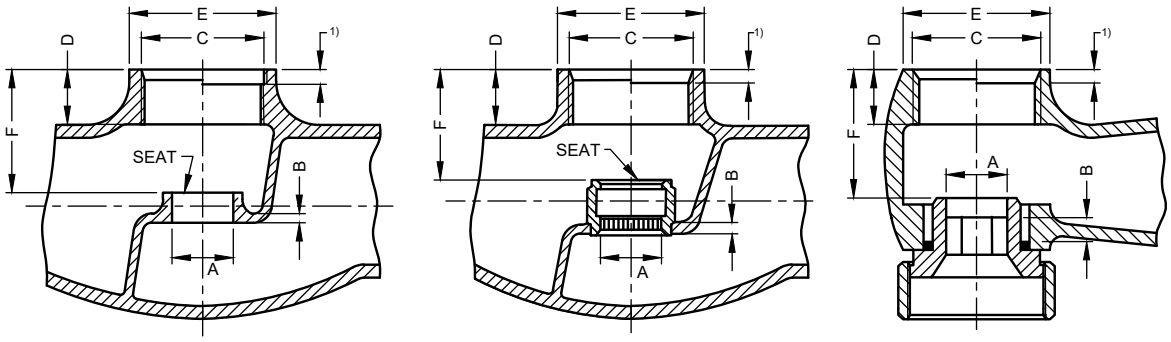
7.2 Single Lever Mixer

7.2.1 Dimensions of bodies for concealed diverter for bath and shower mixer shall conform to those specified in Table 10 read with Fig. 9. Dimensions of bodies for single lever sink mixer with swivel spout shall conform to those specified in Table 11 read with Fig. 10. Dimensions of bodies for single lever pillar mounted basin mixer shall conform to those specified in Table 12 read with Fig. 11. Dimensions of bodies for wall mounted single lever sink mixer with swivel spout shall conform to those specified in Table 13 read with Fig. 12. Dimensions of bodies for single lever bath and shower mixer shall conform to those specified in Table 14 read with Fig. 13.

7.2.2 *Diameter of Single Lever Cartridge*

The minimum nominal diameter of the single lever mixer cartridge shall be 35 mm.

7.2.3 Wherever the nuts are used for connecting the mixers with the braided pipe, the minimum thickness of the nuts shall be 2 mm.



[1] Optional Recessed to a Depth not Exceeding 2½ Threads

NOTE — The design shown are typical/illustrative. However, the dimensional details are for compliance.

Fig. 1 Typical Details of Body To Bonnet Connection

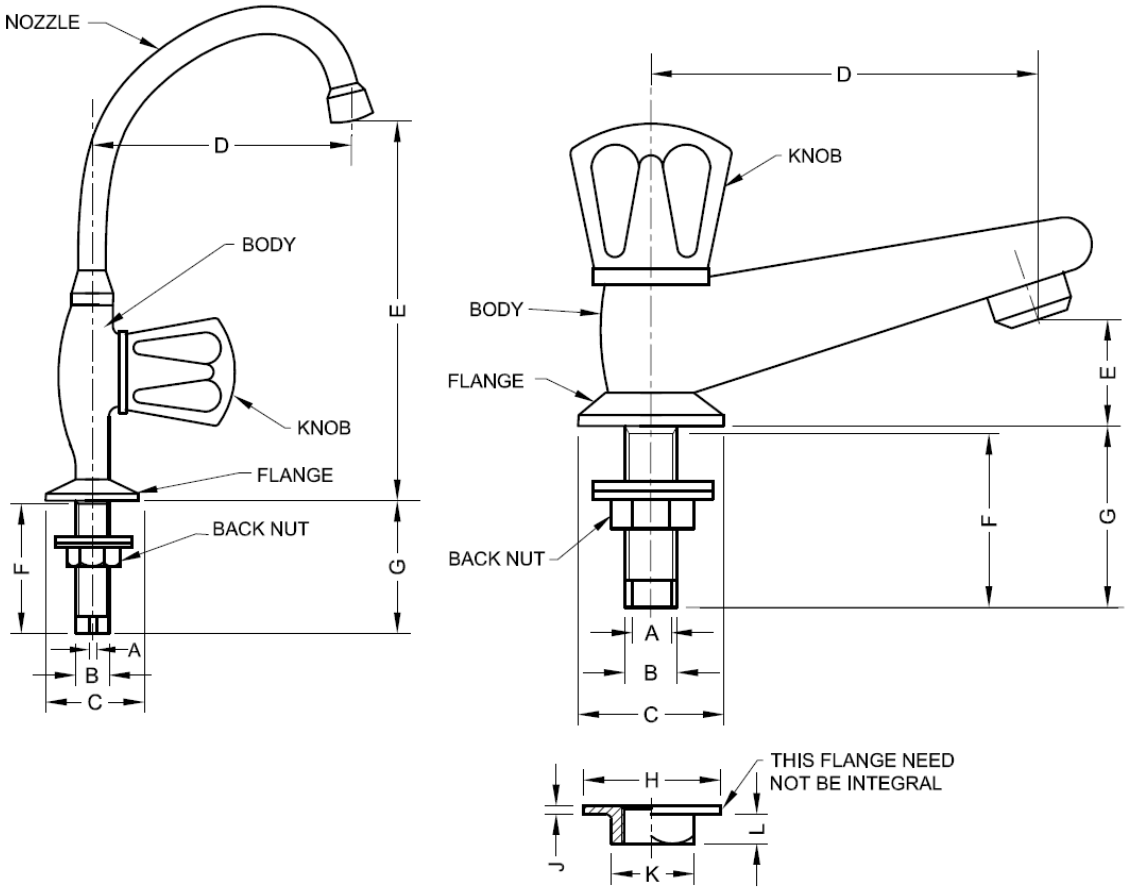
Table 2 Dimension of Body to Bonnet Connection

(*Clauses* 6.7.1, 6.9.1 *and* 7.1.2.1)

All dimensions in millimetres.

Sl No.	**Particular** (*see* Fig. 1)	**Dimensions for Nominal Size**	
		15	20
(1)	(2)	(3)	(4)
i)	Bore of seating, *A*	10.0 to 12.0	12.7 to 16.5
ii)	Thickness of metal supporting seat, *B*	2.0, *Min*	2.0, *Min*
iii)	Connection thread, *C*	G 1/2[1)]	G 3/4[1)]
iv)	Length of internal thread on body, *D*	9.0, *Min*	9.0, *Min*
v)	Outer diameter of body, *E*	24.0, *Min*	31.0, *Min*
vi)	Face of body to face of seating, *F*	21.0, *Min*	24.0, *Min*

[1)] Conforming to IS 2643.



NOTE — The designs shown are typical/illustrative. However, the dimensional details are for compliance.

FIG. 2 TYPICAL DETAILS OF BODIES FOR PILLAR TAPS

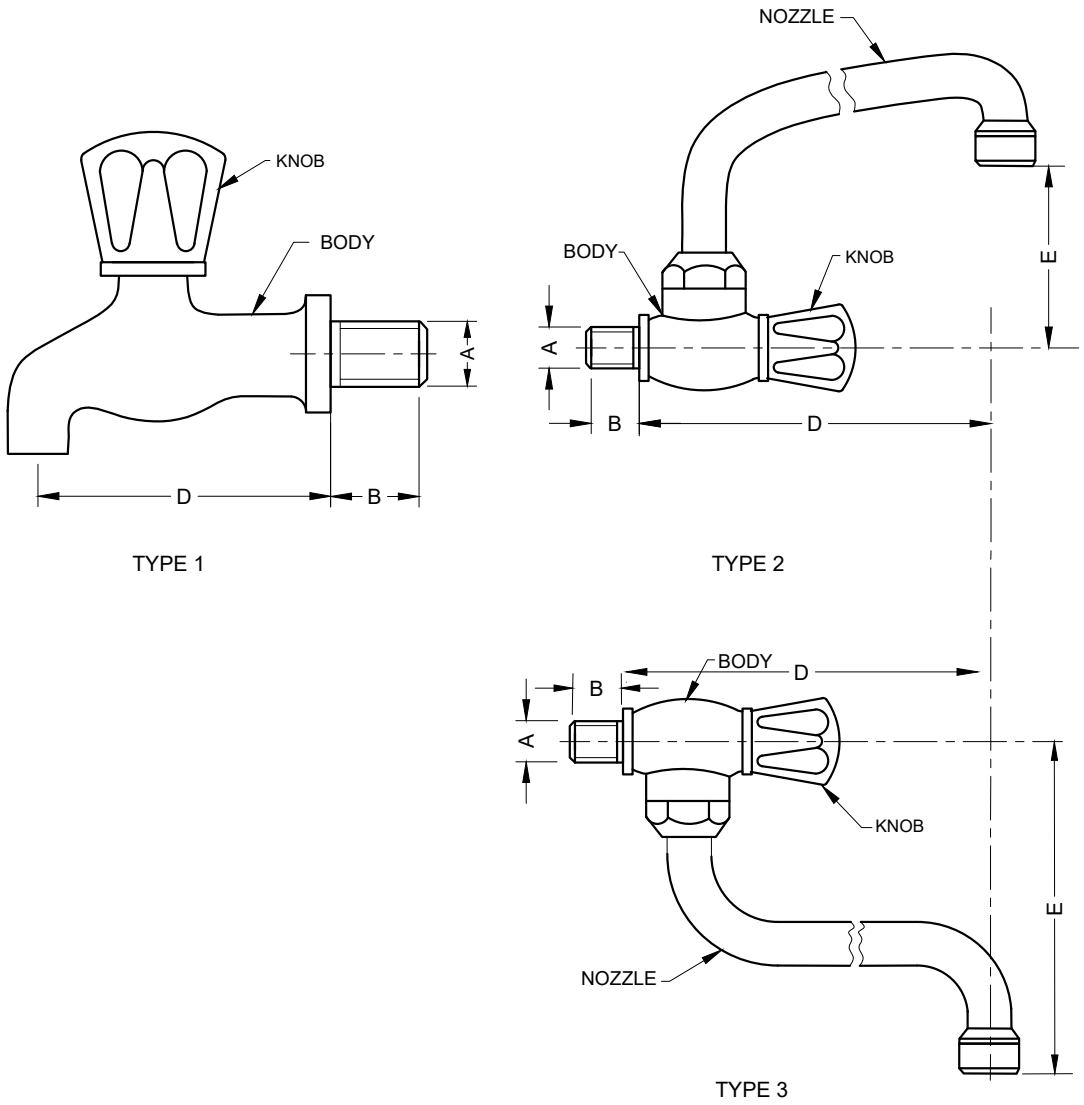
Table 3 Dimensions of Bodies for Pillar Tap, Nominal Size 15 mm

(*Clause* 7.1.2.4)

All dimensions in millimetres.

Sl No.	Particulars (*see* Fig. 2)	Dimensions
(1)	(2)	(3)
i)	Bore of inlet shank, *A*	14.5, *Max*
ii)	Thread of inlet shank, *B*	G1/2 B[1)]
iii)	Diameter of base of flange, *C*	42, *Min*
iv)	Horizontal length from centre of body to centre of outlet, *D*	80, *Min*
v)	Height from flange to centre of outlet, *E*	25, *Min*
vi)	Length of thread, *F*	42, *Min*
vii)	Length of shank, *G*	50, *Min*
viii)	Diameter of flange, *H*	38, *Min*
ix)	Thickness of flange, *J*	2, *Min*
x)	Size across flats, *K*	25, *Min*
xi)	Heights of flats, *L*	7, *Min*

[1)] Conforming to IS 2643.



NOTE — The designs shown are typical/illustrative. However, the dimensional details are for compliance.

FIG. 3 TYPICAL DETAILS OF BODIES FOR BIB TAPS

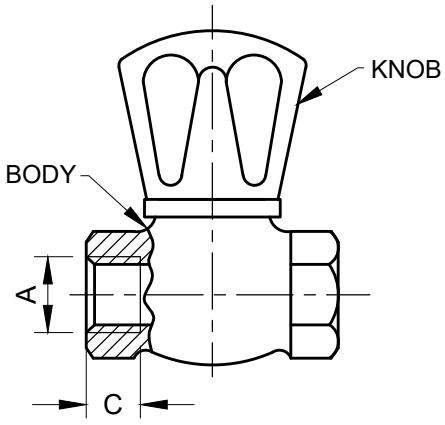
Table 4 Dimensions of Bodies for Bib Tap, , Nominal Size 15 mm

(*Clause* 7.1.2.4)

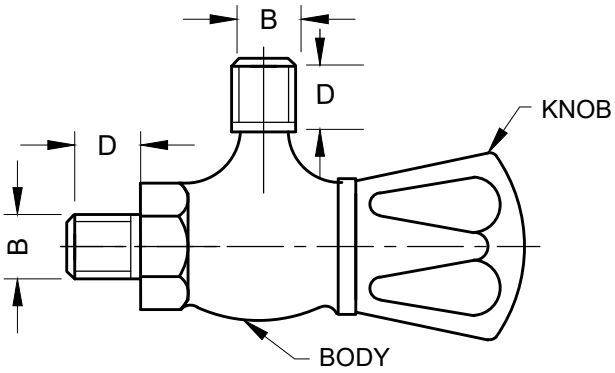
All dimensions in millimetres.

Sl No.	**Particular** (*see* Fig 3)	**Dimensions**
		Min
(1)	(2)	(3)
i)	Thread of Inlet shank, *A*	G 1/2 B[1)] / R 1/2[1)]
ii)	Length of shank, *B*	11, *Min*
iii)	Length from flange to centre of spout, *D*	70, *Min* for Type 1 150, *Min* for Type 2 and Type 3
iv)	Height between centre of the body and centre of spout, *E*	20, *Min*

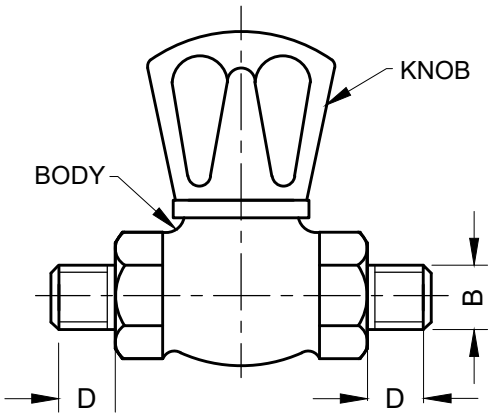
[1)] Conforming to IS 2643 or IS 554



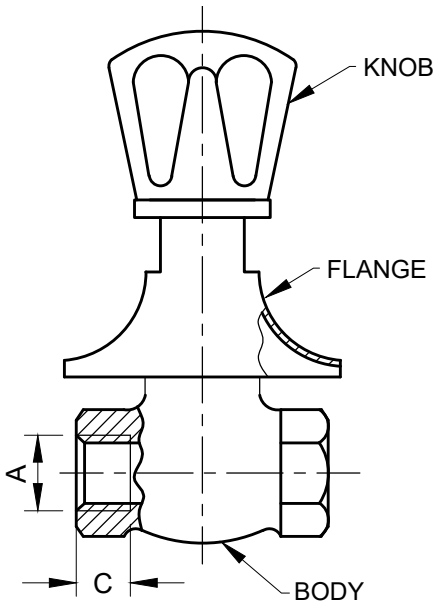
4A Stop Valve with Internal Thread



4B Angle Stop Valve



4C Stop Valve with External Thread



4D Concealed Stop Valve

NOTE — The designs shown are typical/illustrative. However, the dimensional details are for compliance.

Fig. 4 Typical Details of Bodies for Stop Valves and Angle Stop Valves

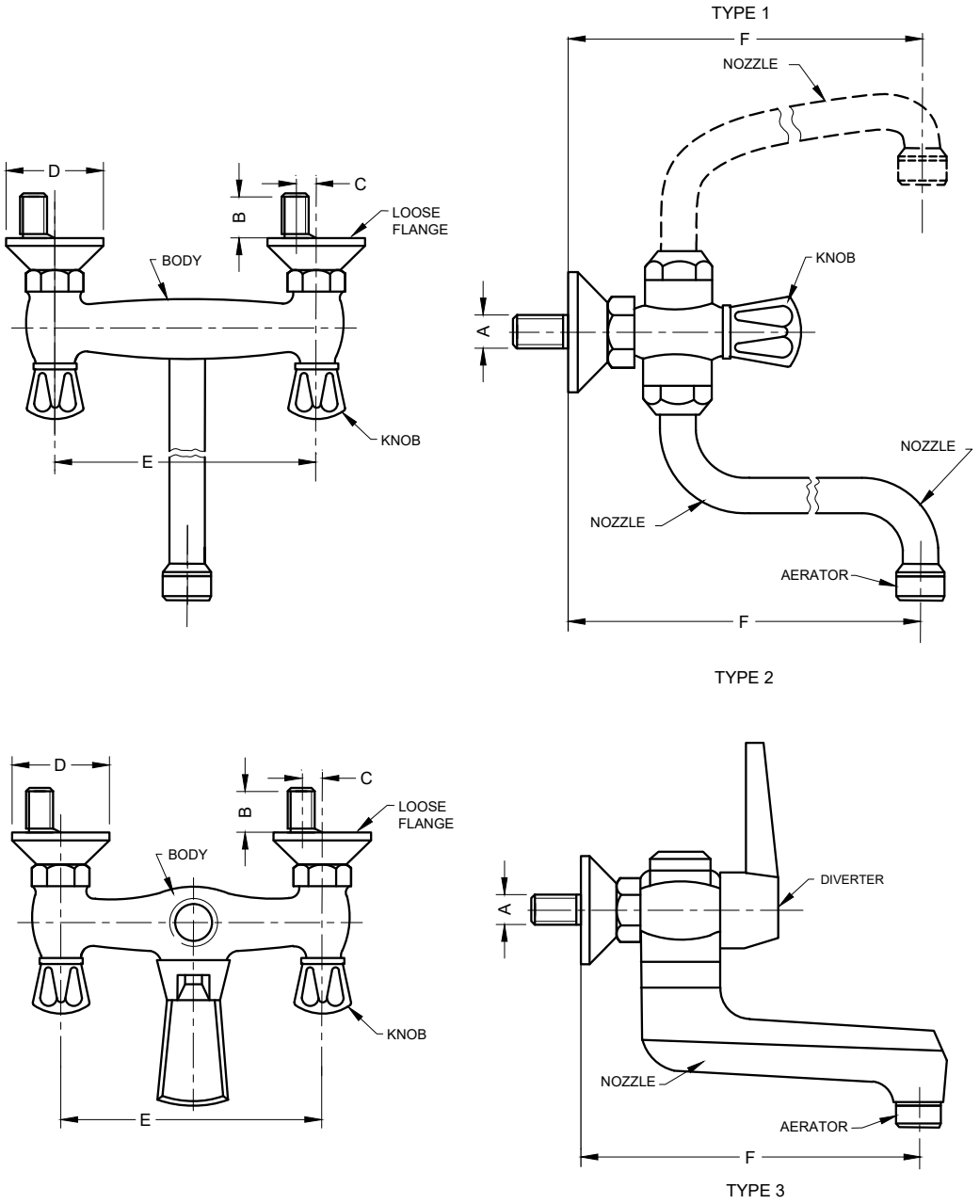
Table 5 Dimensions of Bodies for Stop Valves and Angle Stop Valves

(*Clause* 7.1.2.5)

All dimensions in millimetres.

Sl No.	Particulars (*see* Fig. 4)	Dimensions for Nominal Size	
		15	20
(1)	(2)	(3)	(4)
i)	Thread of inlet shank, *A* (*see* Fig. 4A and Fig. 4D)	G 1/2[1)]/Rp 1/2[1)]	G 3/4[1)]/Rp 3/4[1)]
ii)	Thread of inlet shank, *B* (*see* Fig. 4B and Fig. 4C)	G 1/2 B[1)]/R 1/2[1)]	G 3/4 B[1)]/R 3/4[1)]
iii)	Length of shank, *C* (*see* Fig. 4A and Fig. 4D)	9, *Min*	10.5, *Min*
iv)	Length of shank, *D* (*see* Fig. 4B and Fig. 4C)	11, *Min*	12, *Min*

[1)] Conforming to IS 2643 or IS 554.



NOTE — The designs shown are typical/illustrative. However, the dimensional details are for compliance.

FIG. 5 TYPICAL DETAILS OF BODIES FOR WALL MOUNTED COMBINATION TAP ASSEMBLY

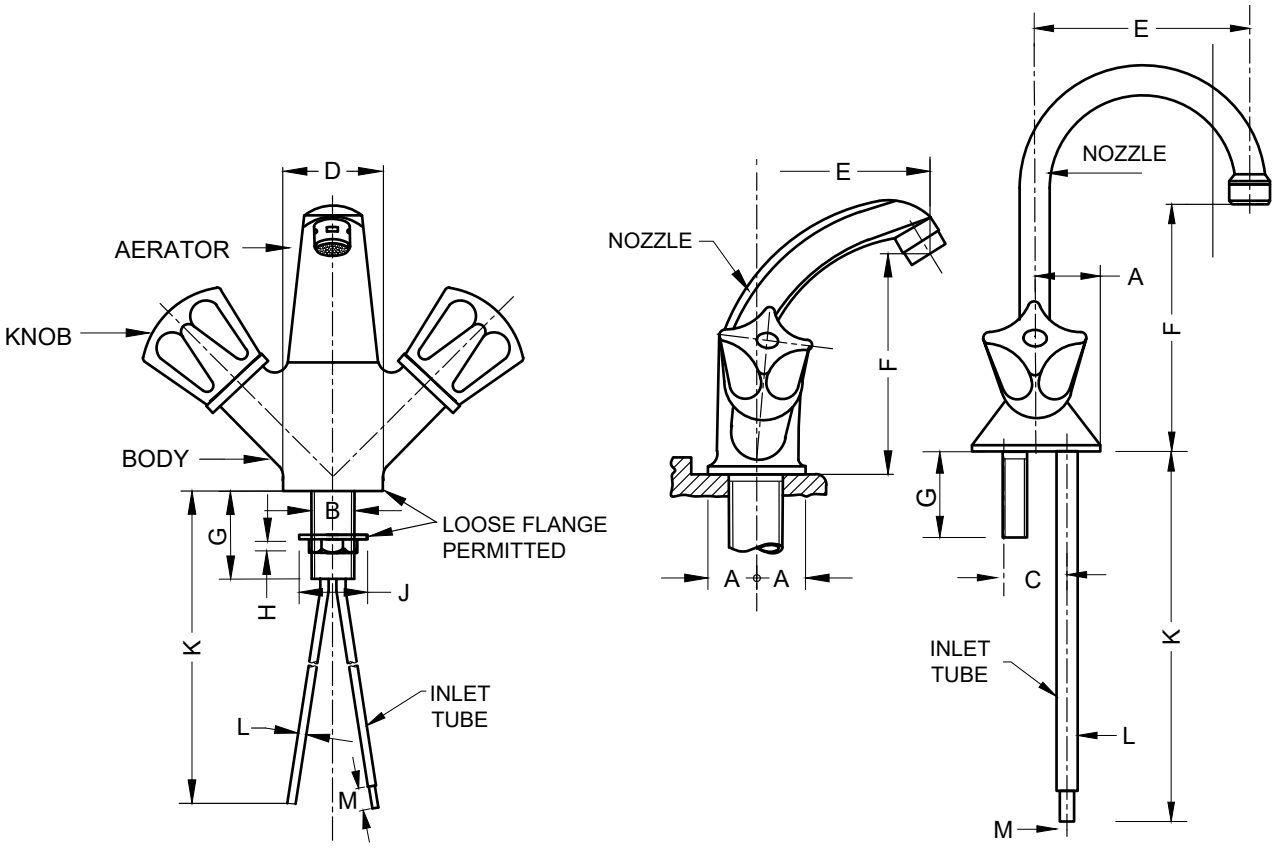
Table 6 Dimensions of Bodies for Wall Mounted Combination Tap Assembly, Nominal Size 15 mm

(*Clause* 7.1.2.6)

All dimensions in millimetres.

Sl No.	**Particulars** (*see* Fig. 5)	**Dimensions**
(1)	(2)	(3)
i)	Thread of inlet shank, *A*	G 1/2 B[1)]
ii)	Length of inlet shank, *B*	25, *Min*
iii)	Adjustment range of S-union, *C*	5, *Min*
iv)	Diameter of flange, *D*	50, *Min*
v)	Distance between centres of inlets, *E*	148, *Min*
vi)	Length from flange to centre of spout, *F*	200, *Min* for Type 1 and Type 2 135, *Min* for Type 3

[1)] Conforming to IS 2643 or IS 554.



NOTE — The designs shown are typical/illustrative. However, the dimensional details are for compliance.

FIG. 6 TYPICAL DETAILS OF BODIES FOR ONE-HOLE PILLAR MOUNTED COMBINATION TAP ASSEMBLY

Table 7 Dimensions of Bodies for One-hole Pillar Mounted Combination Tap Assembly, Nominal Size 15 mm

(*Clause* 7.1.2.6)

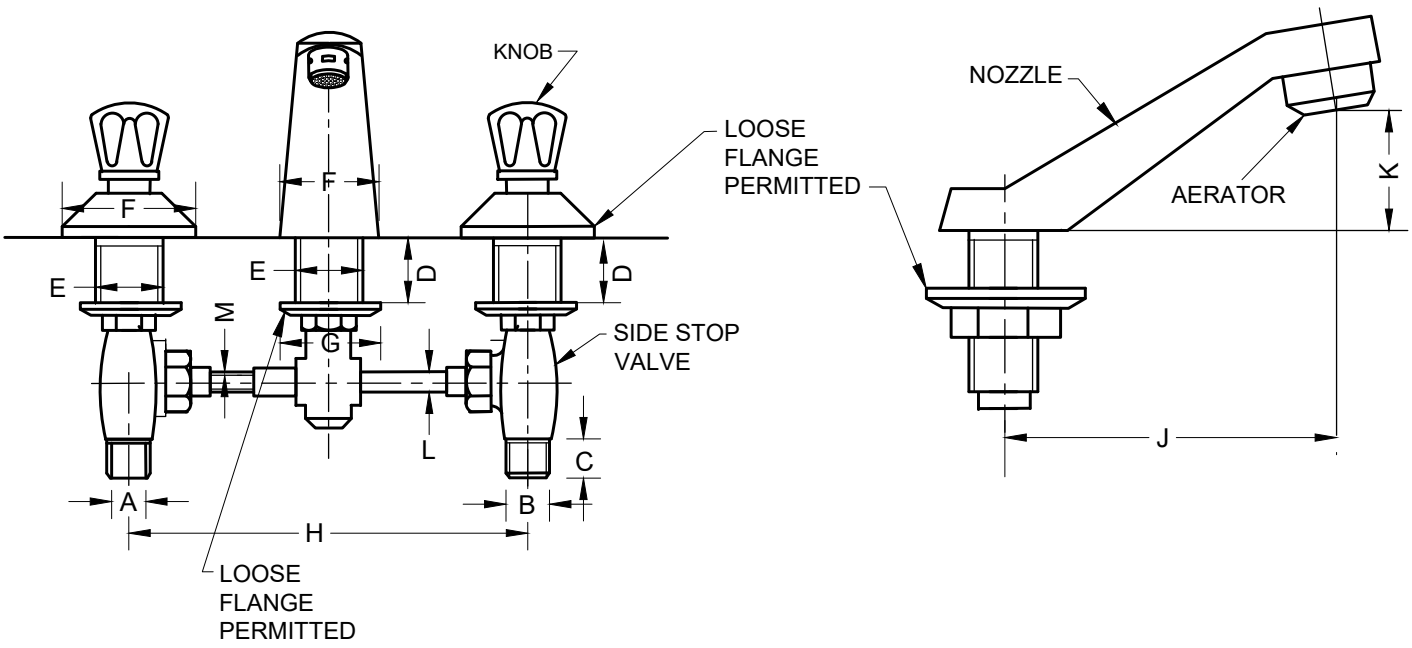
All dimensions in millimetres.

Sl No.	**Particulars** (*see* Fig. 6)	**Dimensions**
(1)	(2)	(3)
i)	Dimension of base form centre of body, *A*	21, *Min*
ii)	Diameter of shank, *B*	33, *Max*
iii)	Outlet dimension, *C*	33.5, *Max*
iv)	Smallest dimension of flange, *D*	42, *Min*
v)	Horizontal length from centre of body to centre of outlet, *E*	80, *Min*
vi)	Height from flange to centre of spout, *F*	40, *Min*
vii)	Length of threaded shank, *G*	25, *Min*
viii)	Depth of hexagon, *H*	7, *Min*
ix)	Diameter of flange, *J*	42, *Min*
x)	Length of connection, *K*	350, *Min*
xi)	Mean outside diameter of copper tube, *L*	9.5, *Min*
xii)	Mean thickness of tube, *M*	0.6, *Min*

NOTES

1 The inlet tubes made of soft annealed copper tubes.

2 Braided hoses may be used, however, it should withstand minimum static pressure of 1 N/mm^2.



NOTE — The design shown is typical/illustrative. However, the dimensional details are for compliance.

FIG. 7 TYPICAL DETAILS OF BODIES FOR THREE-HOLE PILLAR MOUNTED COMBINATION TAP ASSEMBLY

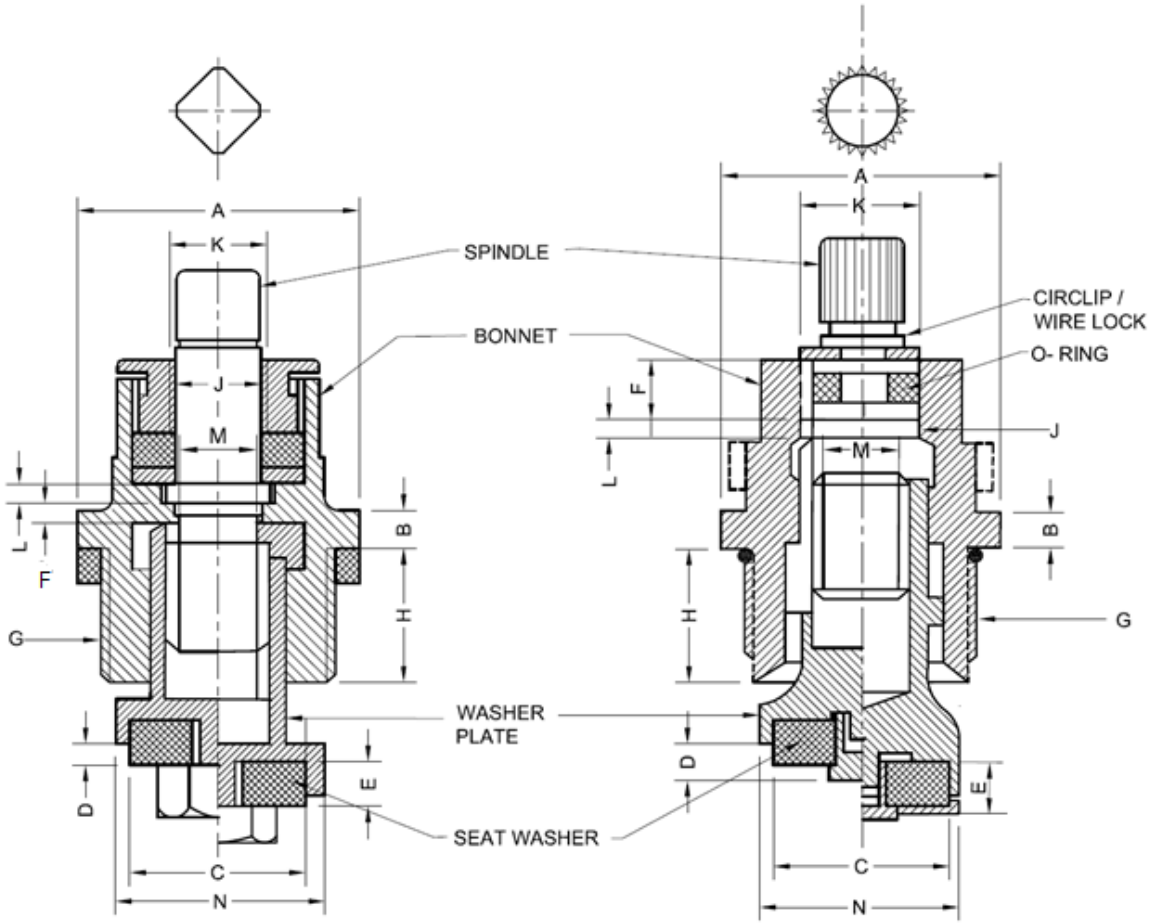
Table 8 Dimensions of Bodies for Three-hole Pillar Mounted Combination Tap Assembly, Nominal Size 15 mm

(*Clause* 7.1.2.6)

All dimensions in millimetres.

Sl No.	**Particulars** (*see* Fig. 7)	**Dimensions**
(1)	(2)	(3)
i)	Bore of inlet shank, *A*	14.5, *Max*
ii)	Thread of inlet shank, *B*	G1/2 B[1)]
iii)	Length of external threaded shank, *C*	8, *Min*
iv)	Height for tightening (adjustable), *D*	5, *Min*
v)	Diameter of shank, *E*	29, *Min*
vi)	Smallest dimension of flange, *F*	42 to 62
vii)	Diameter of flange, *G*	42, *Min*
viii)	Distance between centres of inlet, *H*	195, *Min*
ix)	Horizontal length from centre of body to centre of outlet, *J*	90, *Min*
x)	Height from base of the body to centre of outlet, *K*	25 to 125
xi)	Mean outside diameter of copper tube, *L*	9.5, *Min*
xii)	Mean thickness of tube, *M*	0.6, *Min*

[1)] Conforming to IS 2643.



NOTE — The design shown is typical/illustrative. However, the dimensional details are for compliance.

FIG. 8 TYPICAL DETAILS OF BODIES OF BONNET ASSEMBLY

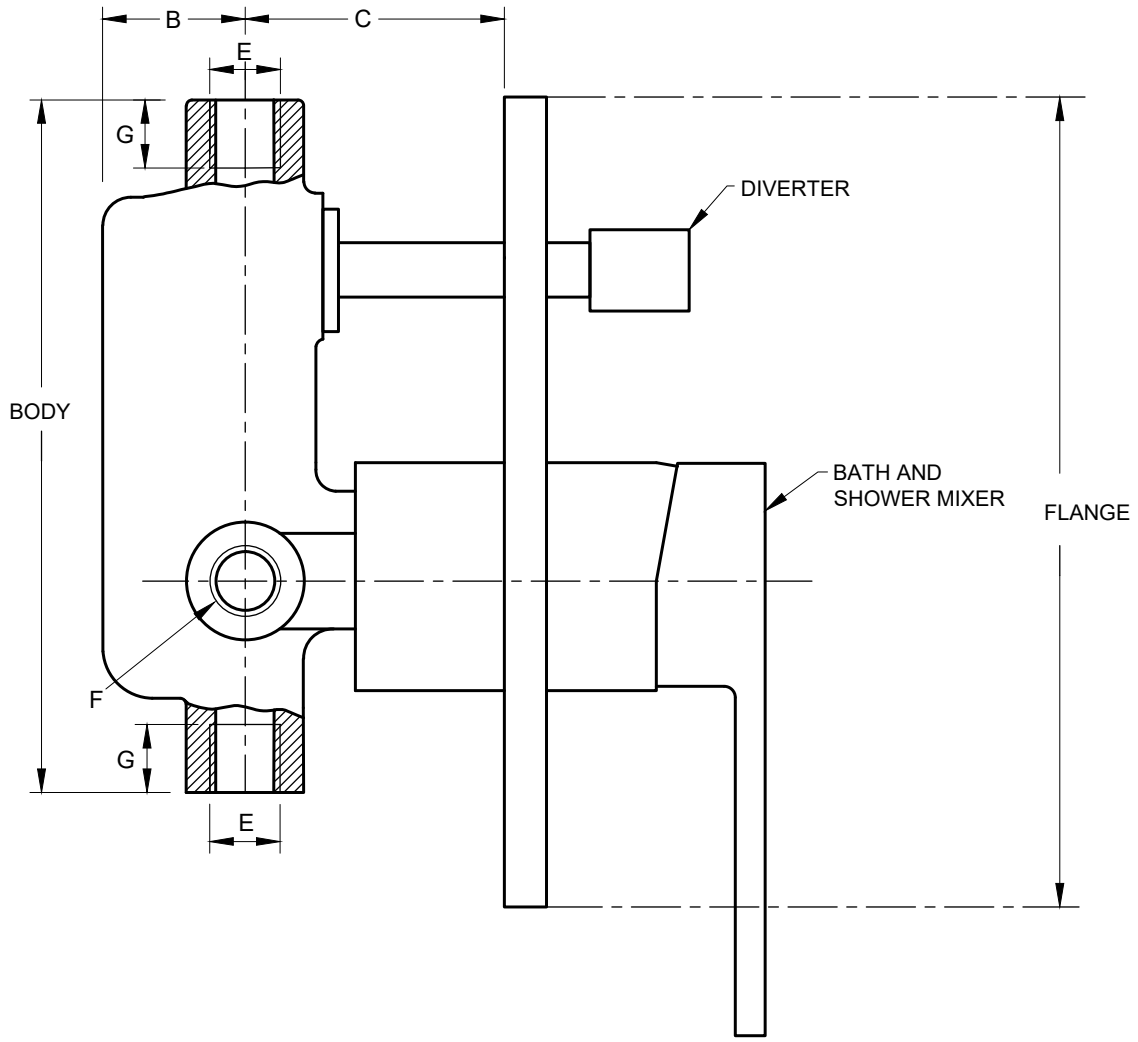
Table 9 Dimensions of Bodies of Bonnet Assembly

(*Clause* 7.1.3.2)

All dimensions in millimetres.

Sl No.	**Particulars** (*see* Fig 8)	**Dimensions for Nominal Size**	
		15	20
(1)	(2)	(3)	(4)
i)	Diameter, *A*	24, *Min*	30, *Min*
ii)	Thickness, *B*	2.0, *Min*	2.5, *Min*
iii)	Diameter of seat washer, *C*	15.6, *Min*	20.6, *Min*
iv)	Projection from edge of washer plate, *D* (applicable for shrouded type only)	1, *Min*	1, *Min*
v)	Thickness of seat washer, *E*	4, *Min*	4, *Min*
vi)	Length of closing thrust collar of bonnet, *F*	2.0, *Min*	2.5, *Min*
vii)	Thread, *G*	G 1/2 B[1)]	G 3/4 B[1)]
viii)	Length, *H*	8, *Min*	9, *Min*
ix)	Diameter of spindle, *J*	6.5, *Min*	9, *Min*
x)	Diameter of thrust collar, *K*	11.8, *Min*	13.8, *Min*
xi)	Thickness of thrust collar, *L*	1.5, *Min*	1.5, *Min*
xii)	Core diameter of spindle actuating, *M*	6.0, *Min*	8.0, *Min*
xiii)	Outside diameter of washer plate, *N*	17.6, *Max*	24, *Max*

[1)] Conforming to IS 2643.



NOTE — The design shown is typical/illustrative. However, the dimensional details are for compliance.

FIG. 9 TYPICAL DETAILS OF BODY OF SINGLE LEVER CONCEALED BATH AND SHOWER MIXER WITH DIVERTER

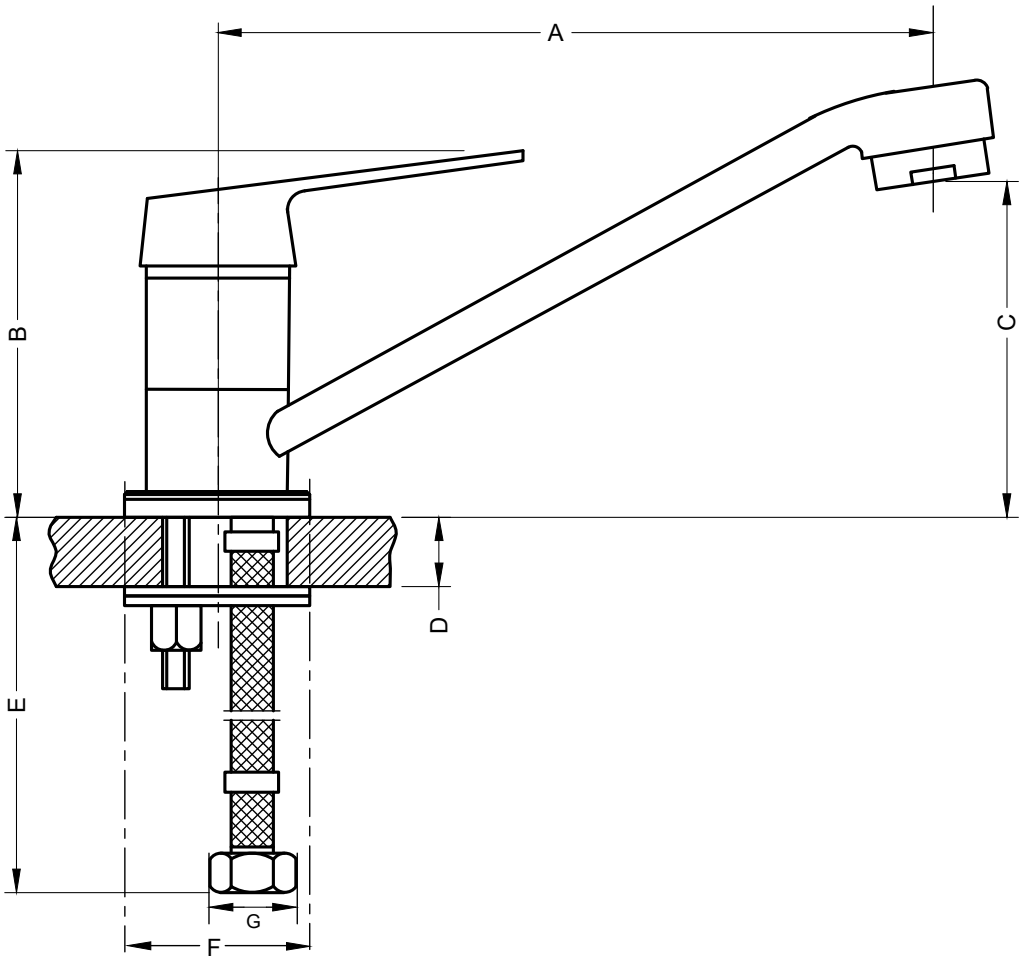
Table 10 Dimensions of Body for Single Lever Concealed Bath and Shower Mixer with Diverter

(*Clause* 7.2.1)

All dimensions in millimetres.

Sl No.	**Particular** (*see* Fig. 9)	**Dimensions**
(1)	(2)	(3)
i)	Dimension of flange, *A*	a) Round flange – ϕ140, *Min* b) Rectangular shape – 100 (W) × 140 (L), *Min* c) Square shape – 140 × 140, *Min*
ii)	Distance between the centre of the thread to the back edge of the flange, *B*	25, *Min*
iii)	Distance between the centre of the thread to the back of the body, *C*	45, *Max*
iv)	Dimensions of the flange	125 (L) × 50 (W), *Min*
v)	Thread of inlet/outlet, E	G 1/2 B[1)] for inlet G 1/2 B[1)] or G 3/4 B[1)] for outlet
vi)	Length of the inlet/outlet thread, *F*	12, *Min* (for both inlet and outlet)

[1)] Conforming to IS 2643 or IS 554.



NOTE — The design shown is typical/illustrative. However, the dimensional details are for compliance.

FIG. 10 TYPICAL DETAILS OF BODY OF SINGLE LEVER PILLAR MOUNTED SINK MIXER WITH SWIVEL SPOUT

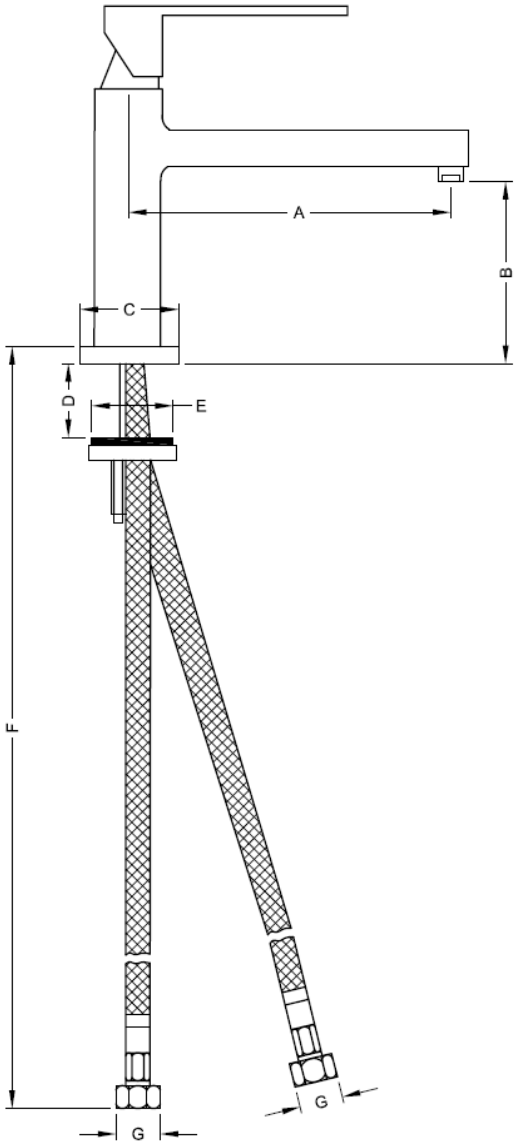
Table 11 Dimensions of Body for Single Lever Pillar Mounted Sink Mixer with Swivel Spout

(*Clause* 7.2.1)

All dimensions in millimetres

Sl No.	**Particulars** (*see* Fig. 10)	**Dimensions**
(1)	(2)	(3)
i)	Horizontal length from the centre of the body to the centre of the outlet of the spout, *A*	200, *Min*
ii)	Height from the base to the top of the lever in off-position, *B*	115, *Min*
iii)	Height from the base of the flange to the centre of the outlet of the spout, *C*	130, *Min*
iv)	Length of thread shank, *D*	20, *Min*
v)	Length of the connecting pipe/ hose, E	350, *Min*
vi)	Diameter of the base of the flange, *F*	42, *Min*
vii)	Connecting nut, G	G 1/2 B[1)]

[1)] Conforming to IS 2643 or IS 554



NOTE — The design shown is typical/illustrative. However, the dimensional details are for compliance.

FIG. 11 TYPICAL DETAILS OF BODY OF SINGLE LEVER PILLAR MOUNTED BASIN MIXER

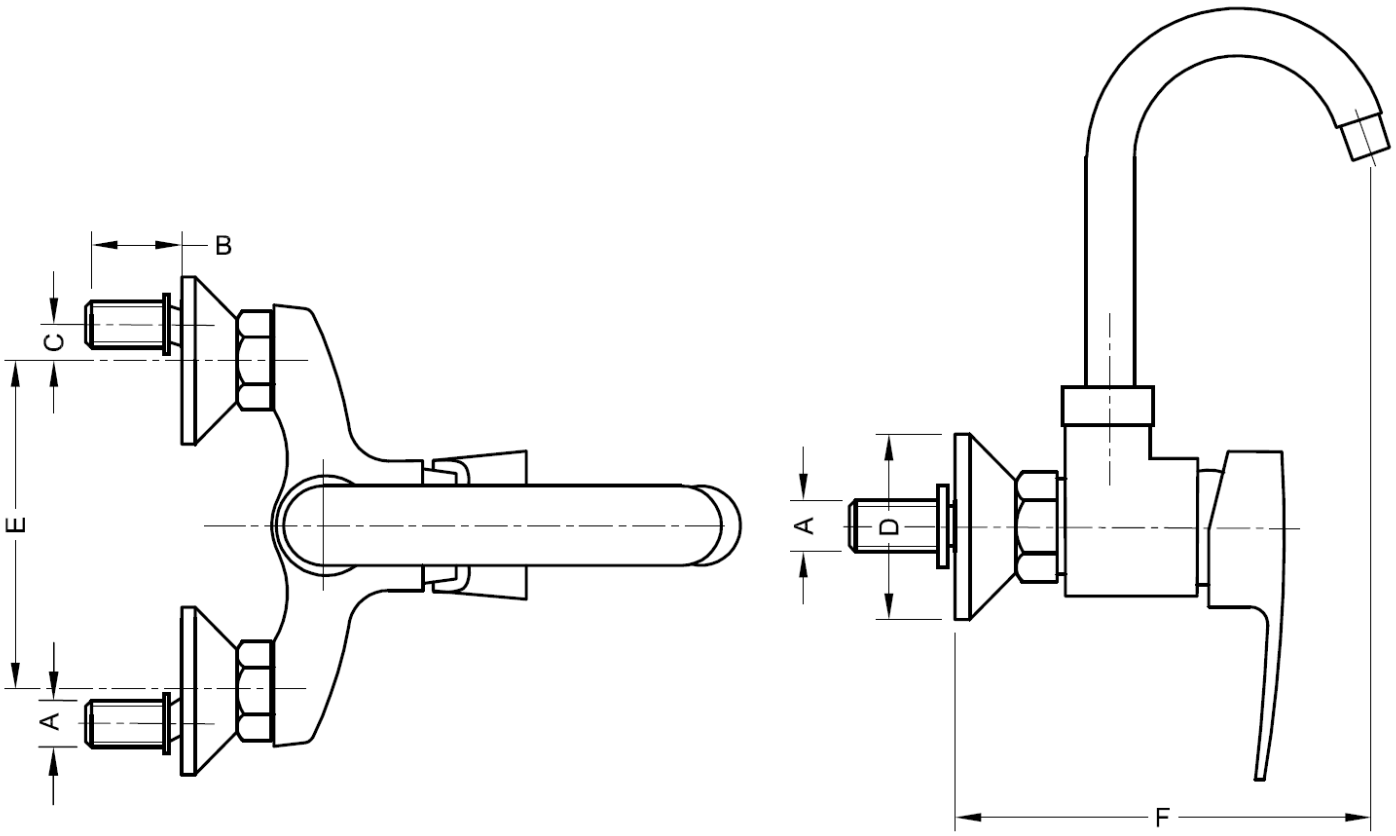
Table 12 Dimensions of Bodies for Single Lever Pillar Mounted Basin Mixer

(*Clause* 7.2.1)

All dimensions in millimetres.

Sl No.	**Particulars** (*see* Fig 11)	**Dimensions**
(1)	(2)	(3)
i)	Horizontal length from the centre of the body to the centre of the outlet of the spout, *A*	75, *Min*
ii)	Height from the base of the flange to the centre of the outlet of the spout, *B*	45, *Min*
iii)	Diameter of the base of the flange, *C*	45 to 52
iv)	Length of the anchoring stud, *D*	65, *Min*
v)	Diameter of the shank, *E*	33, *Min*
vi)	Length of the connecting pipe/hose, *F*	350, *Min*
vii)	Connecting nut, G	G 1/2 B[1)]

[1)] Conforming to IS 2643 or IS 554.



NOTE — The design shown is typical/illustrative. However, the dimensional details are for compliance.

FIG. 12 TYPICAL DETAILS OF BODY FOR SINGLE LEVER WALL MOUNTED SINK MIXER WITH SWIVEL SPOUT

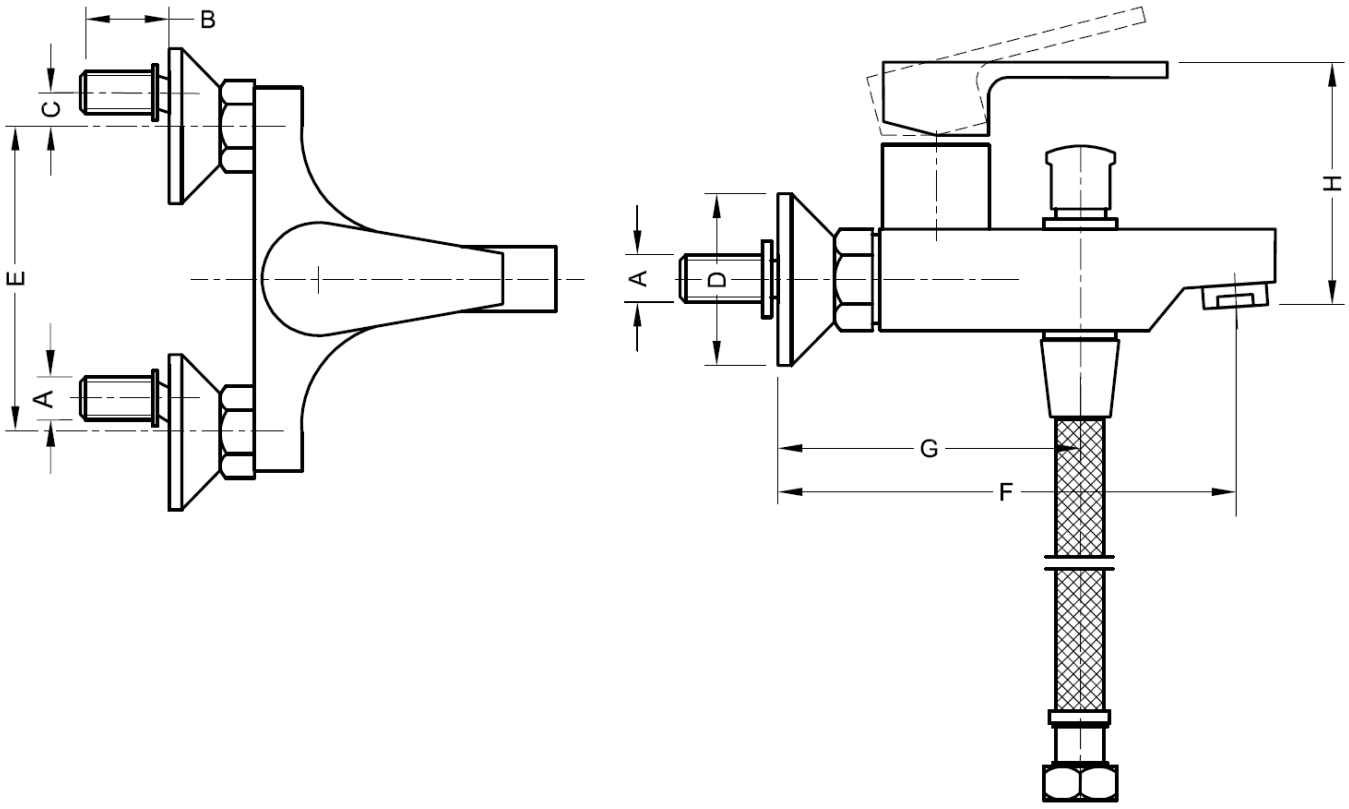
Table 13 Dimensions of Bodies for Single Lever Wall Mounted Sink Mixer with Swivel Spout

(*Clause* 7.2.1)

All dimensions in millimetres.

Sl No.	**Particulars** (*see* Fig. 12)	**Dimensions**
(1)	(2)	(3)
i)	Thread of inlet shank, *A*	G1/2 B[1)]
ii)	Length of shank, *B*	25, *Min*
iii)	Adjustment range of S-union, *C*	5.0, *Min*
iv)	Diameter of flange, *D*	50, *Min*
v)	Distance between centres of inlet, *E*	148, *Min*
vi)	Length from flange to centre of spout, *F*	200, *Min*

[1)] Conforming to IS 2643 or IS 554.



NOTE — The design shown are typical/illustrative. However, the dimensional details are for compliance.

FIG. 13 TYPICAL DETAILS OF BODY OF SINGLE LEVER BATH AND SHOWER MIXER

Table 14 Dimensions of Body of Single Lever Bath and Shower Mixer

(*Clause* 7.2.1)

All dimensions in millimetres.

Sl No.	**Particulars** (*see* Fig. 13)	**Dimension**
(1)	(2)	(3)
i)	Thread of inlet shank, *A*	G 1/2 B[1)]
ii)	Length of shank, *B*	25, *Min*
iii)	Adjustment range of S-union, *C*	10, *Min*
iv)	Diameter of flange, *D*	50, *Min*
v)	Distance between centres of inlet, *E*	148, *Min*
vi)	Distance from flange to centre of spout, *F*	135, *Min*
vii)	Distance from flange to centre of outlet for hand shower, *G*	75, *Min*
viii)	Height from the bottom of the centre of the outlet of the spout to the top of the lever in off-position, *H*	80, *Min*

[1)] Conforming to IS 2643 or IS 554.

8 ADDITIONAL REQUIREMENTS FOR ACCESSIBLE TAPS

8.1 Accessible taps should be single lever mixer or combination tap assembly with lever handle (*see* Notes), complying with other requirements as given in **8.2** to **8.4**.

NOTES

1 Sensor operated accessible taps will be covered in a separate standard.

2 In order to ensure accessibility for persons with disabilities, the requirements relating to installation of sanitary appliances including water closets, are given in Part 3 'Development Controls and General Building Requirements' of SP7 : 2016 'National Building Code of India 2016'.

8.2 The operating control (lever handles) shall be easily operable with one hand with an operating force of not more than 20 N.

8.3 Information, if any should be in raised tactile and Braille signage.

8.4 It is recommended that a thermostat be installed to limit the temperature of the hot water to maximum of 40 °C in order to prevent scalding. Hot and cold water taps should be identifiable by both colour and tactile marking.

9 FINISH

9.1 The significant surfaces of taps, combination tap assemblies, stop valves and single lever mixers shall be nickel-chromium plated. However, the body of concealed stop valve and side stop valve of pillar mounted combination tap assembly may be polished bright or may be unpolished surface, as 'cast' finish.

9.1.1 *Definition of Significant Surfaces*

Significant surfaces are all parts of the article (taps, valves, combination tap assemblies and single lever mixers) covered or to be covered by the coating (plating/polishing) and for which the coating is essential for serviceability and/or appearance of the fitted article. For example, internal surfaces of hollow parts such as cross pieces, caps, knobs are not deemed significant.

9.2 The taps and valves of copper alloy shall be nickel-chromium plated complying with service condition No. 2 (Cu/Ni 10b Cr r) of IS 1068. The knobs and knob components of plastic material may be used in as moulded finish, or nickel-chromium plated complying with service condition No. 2 of IS 8376. The knobs and knob components of zinc base alloy shall be nickel-chromium plated complying with service condition No. 2 (Zn/Cu Ni 15b Cr r) of IS 1068.

10 PERFORMANCE REQUIREMENTS

10.1 All taps, valves and mixers shall be capable of complying with the tests specified in **10.2** to **10.6** The test specified are laboratory tests and not quality control tests during production.

10.2 Water Tightness Characteristic

10.2.1 This test consists of checking under cold water pressure or under air pressure the water tightness of bonnet assembly/operating mechanism on seat, tap, valve and mixer upstream, tap, valve and mixer downstream and bath/shower diverters whether manual or automatically operated.

10.2.2 The test under cold water pressure and air pressure are considered to be equivalent. The choice between one and the other method should be agreed between the purchaser and the test laboratory.

10.2.3 The test equipment, duration and procedure as specified in Annex B shall be followed.

10.2.4 Throughout the duration of test, there shall be no leakage of water or escape of air bubbles respectively, through the walls of the body, the bonnet/operating mechanism and the diverter assembly. Combination tap assembly and single lever mixer when tested in accordance with **B-6**, shall have no leakage or seepage at the outlet or at the end of the unconnected inlet.

10.3 Pressure Resistance Characteristic

10.3.1 This test consists of revealing any deformation in the tap and valve that may result under the action of cold water at a relatively high pressure. The test shall be carried out upstream of the taps, valves and mixers.

10.3.2 Criteria for conformity shall be that no permanent deformation in the part of the taps, valves and mixers shall be produced.

10.3.3 The test equipment, procedure and duration as specified in Annex C shall be followed.

10.4 Hydraulic Characteristics (Flow Rate)

10.4.1 The value of flow rate shall not be less than 3 *l*/min at 0.05 MPa. If the tap/valve/mixer is fitted with flow straightening or aerating device, the same may be removed for the testing purpose. The measurement shall be carried out with taps and valves fully open.

10.4.2 The test circuit, apparatus and procedure as specified in Annex D shall be followed for a dynamic system.

10.4.3 In case of non-metred fittings, the average maximum difference between the highest and the lowest average flow rate shall not exceed 2.0 *l*/min.

10.4.4 For water efficiency rating, this test is performed to determine the value of the flow rate corresponding to a maximum pressure of 0.42 MPa.

10.5 Mechanical Strength Characteristics

10.5.1 This test is performed to verify the torsional strength of operating mechanism/bonnet assembly to a torque of 6 Nm, in both opening and closing positions.

10.5.2 The required torque of 6 Nm shall be applied and maintained for a period of 5 min either with a torque wrench, having an accuracy of 10 percent, fitted to operating member or a lever arm and device for measuring the force applied. It shall be assured that shear force does not affect the measurement.

10.5.3 The tap, valve and mixer with its operating mechanism (bonnet assembly) shall not be supplied with water during the test.

10.5.4 Throughout the duration of test and at the end of test, there shall be no permanent deformation or loosing of any part of the tap, valve and mixer.

10.6 Mechanical Endurance Characteristics

10.6.1 The mechanical endurance test of the operating mechanisms (head and handle) of taps, valves and mixers shall satisfy the leak tightness test requirement as described in **B-3**.

10.6.2 The test equipment, duration and procedure as specified in Annex E shall be followed.

11 ADDITIONAL REQUIREMENTS FOR WATER EFFICIENCY

For water efficiency rating and labelling of taps, valves, combination tap assemblies, single lever mixers, the requirements given in IS 17650 (Part 2) shall be complied with.

12 SAMPLING AND CRITERIA FOR CONFORMITY

The sampling procedure to be adopted and criteria for conformity shall be as given in Annex F.

13 MARKING

13.1 Each pillar tap, bib tap, combination tap assembly, stop valve and angle stop valve and single lever mixer shall be legibly marked with the following information:

a) Manufacturer's name or trade-mark.

b) Letter 'H' or 'C' or alternatively fire red or blue colour for taps meant for hot water or cold water applications. In the case of combination tap assembly and single lever mixer, the hot water supply and marking for the same shall be on the left, and those for cold water on the right.

c) Direction of flow in case of stop valves.

13.2 The packing of the product shall be marked legibly and indelibly with the following:

a) Manufacture's name or trade mark;

b) Nominal size of valve; and

c) Batch number and date of manufacture.

13.3 Accessible taps shall be marked with the international sign of accessibility as given in Part 3 'Development Controls and General Building Requirements' of SP7 : 2016 'National Building Code of India 2016', on the carton/packing.

13.4 BIS Certification Marking

Each pillar tap, bib tap, combination tap assembly, stop valve and angle stop valve, single lever mixer conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act,* 2016 and the Rules and Regulations framed thereunder, and the tap may be marked with the Standard Mark.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
292 : 1983	Specification for leaded brass ingots and casting (*second revision*)
319 : 2007	Free cutting brass bars, rods and section — Specification (*fifth revision*)
407 : 1981	Specification for brass tubes for general purposes (*third revision*)
410 : 1977	Specification for cold rolled brass sheet, strip and foil (*third revision*)
554 : 1999	Pipe threads where pressure — Tight joints are made on the threads — Dimensions, tolerances and designation (*fourth revision*)
713 : 1981	Specification for zinc base alloy ingots for die casting (*second revision*)
742 : 1981	Specification for zinc base alloy die castings (*second revision*)
781 : 1984	Specification for cast copper alloy screw down bib taps and stop valves for water services (*third revision*)
1068 : 1993	Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium — Specification (*third revision*)
1264 : 1997	Brass gravity die castings — Specification *(fourth revision)*
2643 : 2005	Pipe threads where pressure-tight joints are not made on the threads — Dimensions, tolerances and designation (*third revision*)
4454	Steel wires for mechanical springs
(Part 4) : 2001	Stainless steel wire (*second revision*)
4905 : 2015	Random sampling and randomization procedures (*first revision*)
6911 : 2017	Stainless steel plate, sheet and strip — Specification (*second revision*)
6912 : 2005	Copper and copper alloys forging stock and forging — Specification (*second revision*)
7608 : 1987	Specification for phosphor bronze wire for general engineering purposes (*first revision*)
7814 : 2005	Phosphor bronze sheet, strip and foil — Specification (*second revision*)
8376 : 1988	Specification for electroplated coatings of nickel plus chromium on plastics for decorative purposes (*first revision*)
9844 : 1981	Methods of testing corrosion resistance of electroplated and anodized aluminium coatings by neutral salt spray test
9975	Specification for ‘O’ rings
(Part 1) : 1981	Dimensions
(Part 2) : 1984	Material selection and quality acceptance criteria
10446 : 1983	Glossary of terms relating to water supply and sanitation
10773 : 1995	Wrought copper tubes for refrigeration and air — Conditioning purposes — Specification (*first revision*)
IS 17650 (Part 2) : 2021	Water efficient plumbing products — Requirements: Part 2 Sanitary fittings
SP 7 : 2016	National Building Code of India 2016

ANNEX B

(*Clauses* 10.2.4 *and* 10.6.1)

WATERTIGHTNESS CHARACTERISTICS TEST

B-1 GENERAL

This test is carried out to verify the water tightness of the complete tap, valve and mixer specimen.

B-2 TEST EQUIPMENT

B-2.1 For Water Test

The hydraulic test circuit shall be capable of producing the static and dynamic pressures required and maintaining them for the duration of the test.

B-2.2 For Air Test under Water

The test set-up shall include a tank filled with water and its accessories, and a pneumatic circuit that can deliver the required pressure and maintain it for the duration of the test.

B-2.3 For Flow Diverter

The test set-up shall include a flow diverter (automatic/manually lockable) having a nominal flow of minimum 5.0 litre per minute at a dynamic pressure of 0.3 MPa.

B-2.4 Test Duration

The duration given in **B-3** to **B-5** are minimum time periods.

B-3 PROCEDURE FOR CHECKING THE WATERTIGHTNESS OF THE OPERATING MECHANISM/BONNET ASSEMBLY ON THE SEAT, AND THE WATERTIGHTNESS OF THE TAPS, VALVES AND MIXERS UPSTREAM

B-3.1 Water Test

a) Connect the tap/valve/mixers specimen to the test circuit;

b) With the outlet orifice open generally turned downwards, close the seat (bonnet assembly) using a torque of 1.5 Nm; and

c) Apply water pressure of 1.2 MPa for 60 s.

NOTE — When the water tightness of the spindle is ensured by a stuffing box, the packing gland is loosened.

B-3.2 Air Test under Water

a) Connect the tap/valve/mixers specimen to the test circuit.

b) With the outlet orifice open and generally turned upwards, close the seat (bonnet assembly) using a torque of 1.5 Nm.

c) Completely immerse the tap/valve/mixers specimen in water contained in tank.

d) Apply an air pressure of 0.6 MPa to the tap/valve specimen for 20 s.

NOTE — If the water tightness of the spindle is ensured by a stuffing box, the packing gland is loosened.

B-4 PROCEDURE FOR CHECKING THE WATERTIGHTNESS OF THE TAPS, VALVES AND MIXERS DOWNSTREAM

B-4.1 Water Test

a) Connect the valve specimen to the test circuit.

b) With the outlet orifice closed and generally turned downwards, open the seat (bonnet assembly).

c) Apply to the valve specimen, a water pressure of 0.4 MPa for 60 s.

d) In addition, for taps, valves and mixers where the water tightness of the spindle is ensured by one or more ‘O’ rings, apply a water pressure of 0.02 MPa for 60 s.

e) In the latter case, begin by applying 0.4 MPa gradually reducing down to the test pressure of 0.02 MPa.

B-4.2 Air Test under Water

a) Connect the valve specimen to the circuit with the outlet orifice closed;

b) Immerse the valve specimen in water contained in the tank;

c) Apply an air pressure of 0.2 MPa for 20 s;

d) In addition, for valves where the water tightness of the spindle is ensured by one or more ‘O’ rings, apply an air pressure of 0.2 MPa for 20 s; and

e) In the latter case, begin by applying 0.2 MPa gradually reducing down to the test pressure of 0.02 MPa.

B-5 PROCEDURE FOR CHECKING THE WATERTIGHTNESS OF MANUALLY OPERATED DIVERTERS

B-5.1 Water Test Procedure

a) Connect the tap in its normal position of use, to the test circuit.

b) Put the diverter in the bath position, the bath outlet being artificially closed and shower outlet being open and generally turned downwards ensuring that there is no water leakage.

c) Apply a static water pressure of 0.4 MPa for 60 s. Check that the water tightness is maintained on the shower side.

d) In addition, when the water tightness of diverter is ensured by one or more 'O' rings, apply a static water pressure of 0.02 MPa for 20 s. In the latter case, begin by applying the highest pressure, then gradually reducing down to the lowest pressure of 0.02 MPa. Check that the water tightness is maintained on the shower side.

e) Put the diverter in the shower position, the shower outlet being artificially closed and the bath outlet being open and generally turned downwards ensuring that there is no water leakage.

f) Apply a static water pressure of 0.4 MPa for 60 s. Check that water tightness is maintained on the bath side.

g) In addition, if the water tightness of the diverter is ensured by one or more 'O' rings, apply a static water pressure of 0.02 MPa for 20 s. In the latter case, begin by applying the highest pressure, then gradually reducing down to the lowest pressure of 0.02 MPa. Check that water tightness is maintained on the bath side.

B-5.2 Air Test Procedure under Water

a) Connect the tap in its normal positions of use to the test circuit.

b) Place the diverter in the bath position, with the bath outlet being artificially closed and shower outlet being open and generally turned upwards.

c) Immerse the tap in the water contained in the tank.

d) Apply a static air pressure of 0.2 MPa for 20 s. Check that water tightness is maintained on the shower side, and there is no air leakage.

e) In addition, if the water tightness of the diverter is ensured by one or more 'O' rings, apply a static air pressure of 0.02 MPa for 20 s. In the latter case begin by applying the highest pressure of 0.02 MPa. Check that water tightness is maintained on the shower side.

f) Put the diverter in the shower position with the shower side outlet being artificially closed and the bath side outlet being opened and generally turned upwards.

g) Immerse the tap in the water contained in the tank.

h) Apply a static air pressure of 0.2 MPa for 20 s. Check that water tightness is maintained on the bath side, and there is no air leakage.

j) In addition, if the water tightness of the diverter is ensured by one or more 'O' rings, apply a static air pressure of 0.02 MPa for 20 s. In the latter case begin by applying the highest pressure then gradually reducing down to the lowest pressure of 0.02 MPa. Check that water tightness is maintained on the bath side.

B-5.3 Procedure for Checking the Water Tightness of Flow Diverters (Automatic/Manually Lockable)

The test shall be carried out with water only as per the procedure described below:

a) Connect the tap, in its normal position of use, to the test circuit with outlet orifices open and generally turned downwards. Connect the flow regulator (*see* **B-2.3**), to the shower outlet.

b) Put the diverter in the bath position, and apply a dynamic water pressure of 0.4 MPa for 60 s. Check that water tightness is maintained on the shower side.

c) Put the diverter in shower position, check that water tightness is maintained on the bath side.

d) With the diverter still in shower position, reduce the dynamic pressure to 0.05 MPa. Check that the diverter has not disengaged. Maintain this pressure for 60 s and check that water tightness is maintained on the bath side.

e) Stop the water, check that the diverter returns to the bath position.

f) Re-apply the dynamic pressure of 0.05 MPa for 60 s. Check that the water tightness is maintained on the shower side.

B-6 PROCEDURE FOR CHECKING THE WATER TIGHTNESS OF THE OPERATING MECHANISM/BONNET ASSEMBLY FOR NO CROSS FLOW BETWEEN HOT WATER AND COLD WATER

a) Connect one end of the combination tap assembly/single lever mixer to the test circuit.

b) With the outlet orifice open and the bonnet assembly/operating mechanism open, apply a water pressure of 0.4 MPa for 60 s. In this period, move the temperature control device over its full operating range.

c) Repeat the text, reversing the water supply connection to the other inlet.

d) Check that the water tightness is maintained at the outlet or at the end of the unconnected inlet.

ANNEX C

(*Clause* 10.3.3)

PRESSURE RESISTANCE CHARACTERISTICS

C-1 GENERAL

This test is the carried out for checking the mechanical behaviour of the body of the tap, valves and mixers under cold water pressure.

C-2 TEST EQUIPMENT

A hydraulic test circuit capable of producing the static and dynamic pressures required and of maintaining them for the test duration.

C-3 PROCEDURE FOR CHECKING THE MECHANICAL BEHAVIOUR UPSTREAM OF THE OPERATING MECHANISM/BONNET ASSEMBLY IN SHUT POSITION

Apply a static water pressure of 2.5 MPa for a duration of 60 s. There should not be any deformation or leakage.

C-4 PROCEDURE FOR CHECKING THE MECHANICAL BEHAVIOUR DOWNSTREAM OF THE BONNET ASSEMBLY/OPERATING MECHNAISM IN OPEN POSITION

Connect the tap/valve/mixer to the test circuit and open the same fully. For taps/valves/mixers with a flow rate regulator fitted, apply at the inlet a dynamic water pressure of 0.4 MPa for a duration of 60 s. For taps/valves/mixers without flow rate regulator and 15 mm nominal size, apply at the inlets, for 60 s, the water pressure needed to give a flow rate of 0.4 *l*/s through the specimen. For valves without flow rate regulator and 20 mm nominal size, apply at the inlets, for 60 s, the water pressure needed to give a flow rate of 0.8 *l*/s through the specimen. Check whether there is permanent deformation in any part of the specimen downstream of the bonnet assembly/operating mechanism. For taps/valves/mixers with removable flow rate regulator, the test shall be carried out both with and without this regulator. There should not be any deformation or leakage.

C-5 PROCEDURE FOR CHECKING THE MECHANICAL BEHAVIOUR OF BODY OF TAPS, VALVES AND MIXERS

Remove the bonnet assembly and close the bonnet/cartridge end and the outlet with a plug. Apply a static water pressure of 2.5 MPa for a duration of 60 s, this pressure being measured at the junction of the valve and the pipe. There should not be any deformation or leakage in the body.

ANNEX D

(*Clause* 10.4.2)

HYDRAULIC CHARACTERISTICS

D-1 GENERAL

This test is carried out to measure the flow rate of single and combination taps, valves and single lever mixers together with their standard accessories for a given pressure.

D-2 APPARATUS

The apparatus consists of a supply circuit and a test circuit (*see* Fig. 14).

D-2.1 Supply Circuit

D-2.1.1 The supply circuit assembly consists of,

a) device (A) enabling the required pressure to be achieved;

b) piping (B) with a cross-section such that the test circuit without the tap and valve to be tested, enables a flow rate of 50 percent greater than the flow rate to be measured to be achieved.

c) device (C) to measure the flow rate.

NOTE — This device may also be placed downstream of the test circuit, provided it is separate from the test circuit.

D-2.2 Test Circuit (*see* Fig. 15)

D-2.2.1 The circuit shown in Fig. 15 is suitable whatever be the type of the tap, valve and mixer to be tested. It consists of:

a) a straight portion of tube, having a minimum internal diameter of 13 mm and 19 mm for 15 mm and 20 mm nominal size of taps and valves respectively, with a pressure tapping, as shown in Fig. 15.

b) tap/valve/mixer connecting nut or socket of suitable size; and

c) a pressure circuit, connected to the pressure take-off tee and to the pressure measuring device.

NOTE — The connection between the pressure circuit and measuring apparatus is situated,

a) at the connection level, for all taps [*see* (a) and (c) in Fig. 15] except for tap with combined visible bodies and all mixers with copper inlet pipe of 250 mm minimum length [*see* (b) in Fig. 15]; and

b) 200 mm above the connection level for all types of tap.

Example of the fitting of the tap and valve to the test circuit are shown in Fig. 15.

D-2.2.2 *Pipes*

The pipes shall be of brass/SS 304 and their internal surface shall be smooth.

D-2.2.3 *Pressure Take-off Tee*

The pressure take-off tees shall be made of brass and machined to the dimension as specified in Table 15 read along with Fig. 16.

D-3 TEST CONDITIONS

D-3.1 Precision of the Measurements

The precision of the device for measuring the flow rates and pressures shall be ± 2 percent.

D-3.2 Procedure

a) Connect the tap/valve/mixer specimen to the test circuit.

b) For combination taps with two inlets, the test shall be carried out on each of these inlets separately.

c) For combination taps with combined visible body, reduce, if necessary, the length of the supply tubes to a value of 250 mm.

d) For the taps, valves and mixers, which cannot be connected directly to the test circuit connector, use intermediate connecting device which have minimum head loss.

e) With the outlet orifice closed and generally turned downward, open the seal. Open the tap/valve/mixer to its maximum.

f) Measure the flow rate three times at three different dynamic pressures of 0.1 MPa, 0.3 MPa and 0.5 MPa, and calculate the average flow rate at each pressure. Apply the pressure to the fixture for a duration of (60 ± 5) s and measure the flow rate when a continuous flow has been established.

g) Using logarithmic coordinates, plot the curve of the flow rate (Q) as a function of the pressure (P).

h) Determine on this curve the value of the flow rate corresponding to the pressure of 0.05 MPa and 0.42 MPa.

D-4 CALIBRATION

It is recommended that the measuring appliances and the test circuit be calibrated at regular intervals.

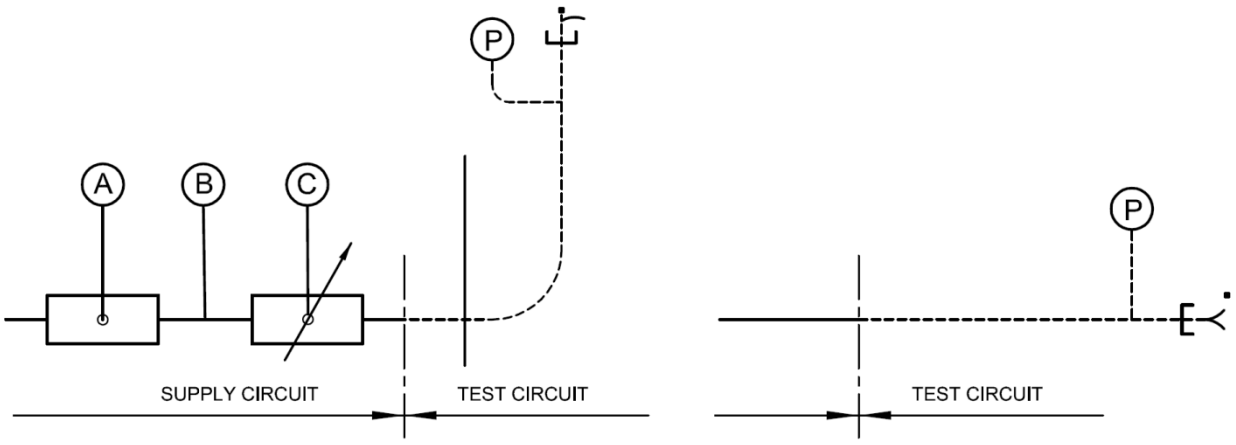
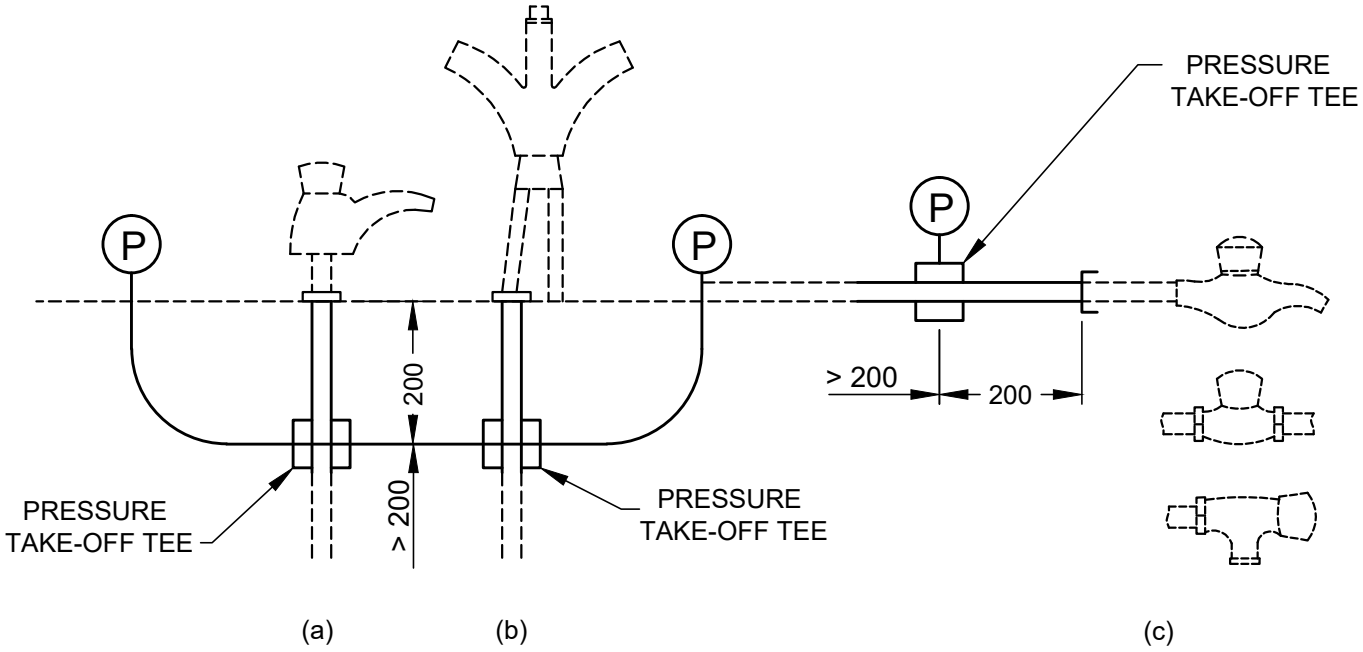
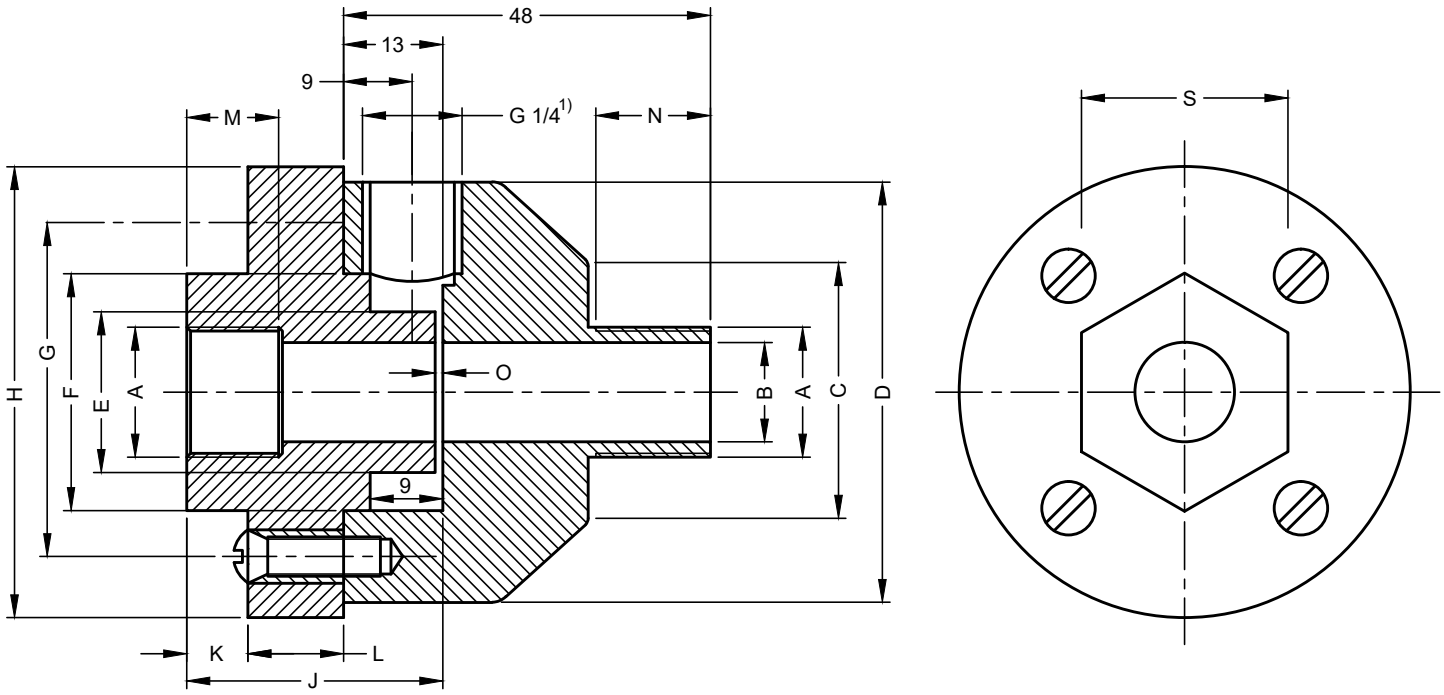


FIG. 14 SUPPLY AND TEST CIRCUIT



All dimensions in millimetres

FIG. 15 TEST CIRCUIT



1) CONFORMING TO IS 2643.

All dimensions in millimetres.

FIG. 16 DIMENSION OF PRESSURE TAKE-OFF TEE

Table 15 Dimensions of Pressure Take-Off Tee

(*Clause* D-2.2.3)

All dimensions in millimetres.

Sl No.	Nominal Size	Thread Size	Particulars (*see* Fig. 16)													Width Across Flats	Bolts	
		A[1]	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*J*	*K*	*L*	*M*	*N*	*O*	S	Number	Size
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
i)	15	G 1/2	13	34	55	21	31	43	59	27	8	12.5	12	15	0.5	27	4	M4 × 16
ii)	20	G 3/4	19	41	62	26	38	50	66	29	10	12.4	14	17	0.6	32	4	M5 × 16

[1] Conforming to IS 2643.

ANNEX E

(*Clause* 10.6.2)

MECHANICAL ENDURANCE CHARACTERISTICS

E-1 MECHANICAL ENDURANCE CHARACTERISTICS OF THE OPERATING MECHANISM – ROTARY HEADWORKS OF SINGLE TAPS AND COMBINATION TAP ASSEMBLIES

E-1.1 General

This test shall be carried out to verify the mechanical endurance of the operating mechanisms (head and handle) of single taps and combination taps of nominal sizes 15 mm and 20 mm. Taps shall first satisfy the leak tightness tests described in **B-3** and **B-4**.

E-1.2 Test Method

E-1.2.1 *Principle*

The principle of the test consists of checking the behaviour of the operating mechanism by carrying out a number of opening and closing operations with water at specified pressure/temperature and with a specified dwell time (*see* Table 16).

E-1.2.2 *Apparatus*

E-1.2.2.1 An automatic test rig, which rotates in both directions, such that the closing torque shall remain constant irrespective of wear of the test piece. The set closing torque shall not be affected by the momentum of the equipment during the test.

E-1.2.2.2 A supply circuit with a pump or a similar device, capable of producing the required pressure at a temperature ≤ 30 °C for the cold water and (65 ± 2) °C for the hot water.

If the water is supplied by a circulation system, it is necessary to ensure that the quality of the water does not change during the test (for example, ingress of grease or other contaminants).

E-1.2.2.3 A device to actuate the operating mechanism of the tap. This shall not impose, by virtue of misalignment or otherwise, any axial or radial forces that would not occur in normal use.

NOTE — The test sample can show abnormal wear due to loads imposed by the test equipment resulting from eccentricity of the two axes. This results in pick-up on one side only due to lateral forces which do not occur in normal use. The tolerance on concentricity should therefore be as small as possible.

E-1.3 Procedure

a) Fit the tap to be tested complete with its handle onto the test rig and connect to the water supply circuit;

Table 16 Endurance Test Conditions for Rotary Headworks of Single Taps and Combination Tap Assemblies

(*Clause* E-1.2.1)

Sl No.	Conditions	Field of Application Supply System
(1)	(2)	(3)
i)	Water temperature, in °C	
	a) Cold water	≤ 30
	b) Hot water	(65 ± 2)
ii)	Flow rate adjusted by throttling outlet, in *l*/min	6 ± 1
iii)	Static pressure, in MPa	0.4 ± 0.05
iv)	Rotations per minute, in rpm	
	a) for elastomeric seal	30 ± 0.1
	b) for ceramic valves	10 ± 0.1
v)	Dwell time in open position, in s	1 to 2
vi)	Dwell time in closed position with applied torque, in s	≤ 0.4
vii)	Total dwell time in closed position, in s	2 to 3
viii)	Closing torque, in Nm	
	a) elastomeric washer	2.5 ± 0.25
	b) ceramic discs	1.5 ± 0.25
ix)	Number of cycles	200 000

b) for taps with elastomeric washer, adjust the closing torque to a constant value of (2.5 ± 0.25) Nm; for ceramic disc valves, adjust the closing torque to a constant value of (1.5 ± 0.25) Nm;

c) with the tap closed, adjust the static water pressure, to (0.4 ± 0.05) MPa;

d) with the tap open, adjust the flow rate, by throttling the outlet of the tap to (6 ± 1) *l*/min;

e) where leak tightness of the spindle is ensured by a stuffing box the gland nut is loosened as follows:

   1) loosen the gland nut;
   2) with the outlet orifice closed, open the obturator; apply a water pressure of 0.1 MPa; and
   3) tighten the gland nut until a watertight seal is just obtained.

E-1.4 Requirement

After testing, the tap shall again satisfy the leak tightness criteria given in **B-3** and **B-4**, and there shall be no failure of any component part.

E-2 MECHANICAL ENDURANCE CHARACTERISTICS OF THE OPERATING MECHANISM – SINGLE LEVER MIXER

E-2.1 General

This test shall be carried out to verify the mechanical endurance of the control device of a mechanical mixing valve. They shall first satisfy the leak tightness test specified in **B-3** and **B-4**.

E-2.2 Test Method

E-2.2.1 *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 (*see* Table 17). 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 for flow rate and temperature, the test is carried out according to **E-2.2.4**.

E-2.2.2 *Apparatus*

This comprises circuits (hot water, cold water) and an automatic machine. Each circuit comprising a pump or similar device, capable of supplying the required pressure at a temperature ≤ 30 °C for the cold water and (65 ± 2) °C for the hot water.

E-2.2.3 *Automatic Machine*

The machine's mechanism shall carry out one of the cycles defined, according to the movement of the mixing valve.

E-2.2.4 *Procedure*

a) Install the mixing valve in its normal position of use on the machine and connect it to both the cold water supply circuit and the hot water supply circuit.

b) Set the maximum force transmitted by the machine to open and close the flow control to a maximum moment, *M* of 3 Nm, and to move the temperature control to a maximum moment M_1 of 3 Nm. The machine shall stop if this torsional resistance value is reached on the mechanism (*see* Fig. 17, Fig. 18, Fig. 19 and Fig. 20).

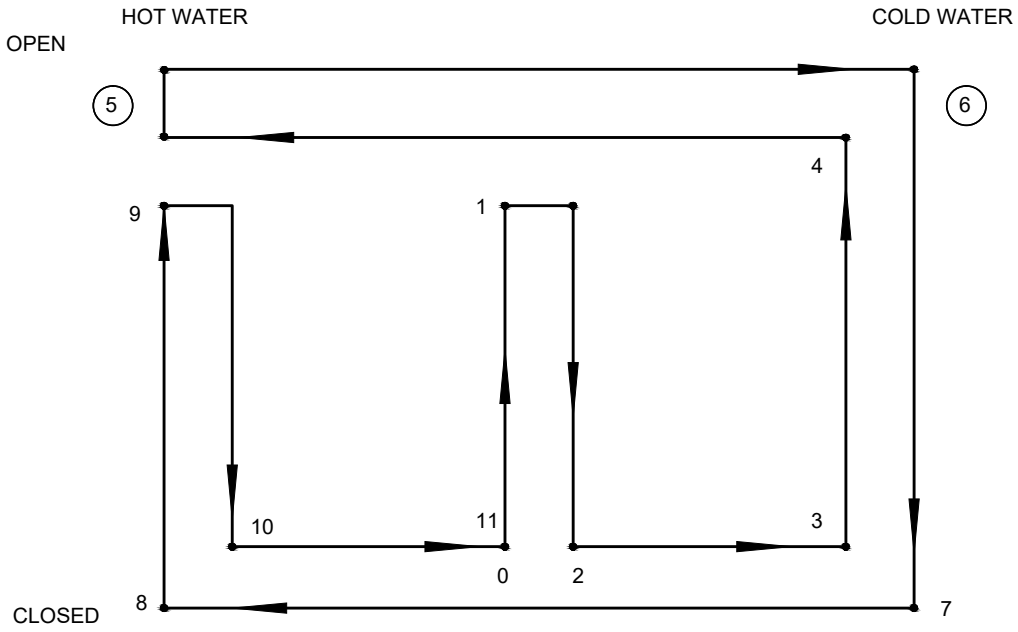
c) With the mixing valve closed, set the hot water and cold water static pressures at the values given in position 0.

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

Table 17 Endurance Test Conditions for Cartridges for Single Lever Mixer

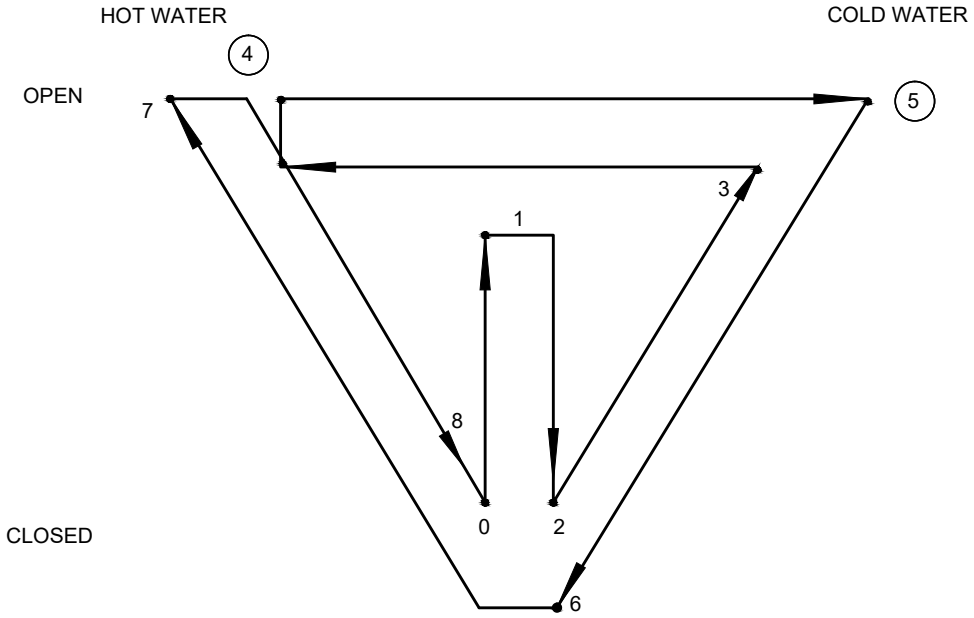
(*Clause* E-2.2.1)

Sl No.	Conditions	Field of Application Supply System
(1)	(2)	(3)
i)	Water temperature, in ° C	
	a) Cold water	≤ 30
	b) Hot water	(65 ± 2)
ii)	Flow rate adjusted by downstream resistance, in *l*/min	6 ± 1
iii)	Static pressure, in MPa	0.4 ± 0.05 MPa
iv)	Speed, in angular/s	(60 ± 5) ° angular/s
v)	Dwell time, in s	5 ± 0.5
vi)	Reversal time on each direction change, in s	0.5 ± 0.5
vii)	*p*H	8 ± 1
viii)	Water hardness	Indication of the measured value in the test report
ix)	Number of cycles	70 000 (rectangular or triangular or separate control movements)



ONE CYCLE 0 TO 11

17A RECTANGULAR MOVEMENT



ONE CYCLE 0 TO 8

17B TRIANGULAR MOVEMENT

For particulars, *see* **E-2.2.4**.

FIG. 17 RECTANGULAR AND TRIANGULAR MOVEMENT

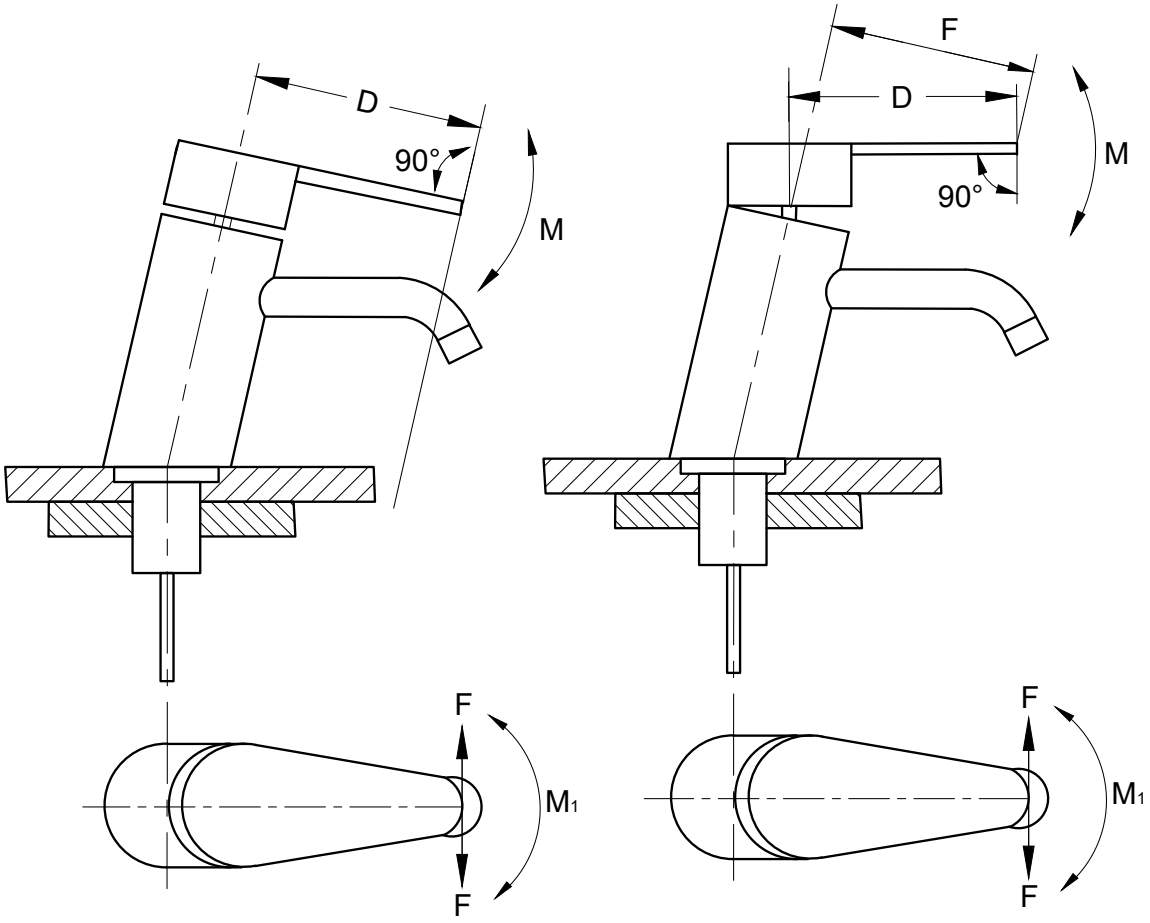


FIG. 18 TEST BENCH FOR JOYSTICK MIXING VALVE SEQUENTIAL CONVENTIONAL MIXING VALVE

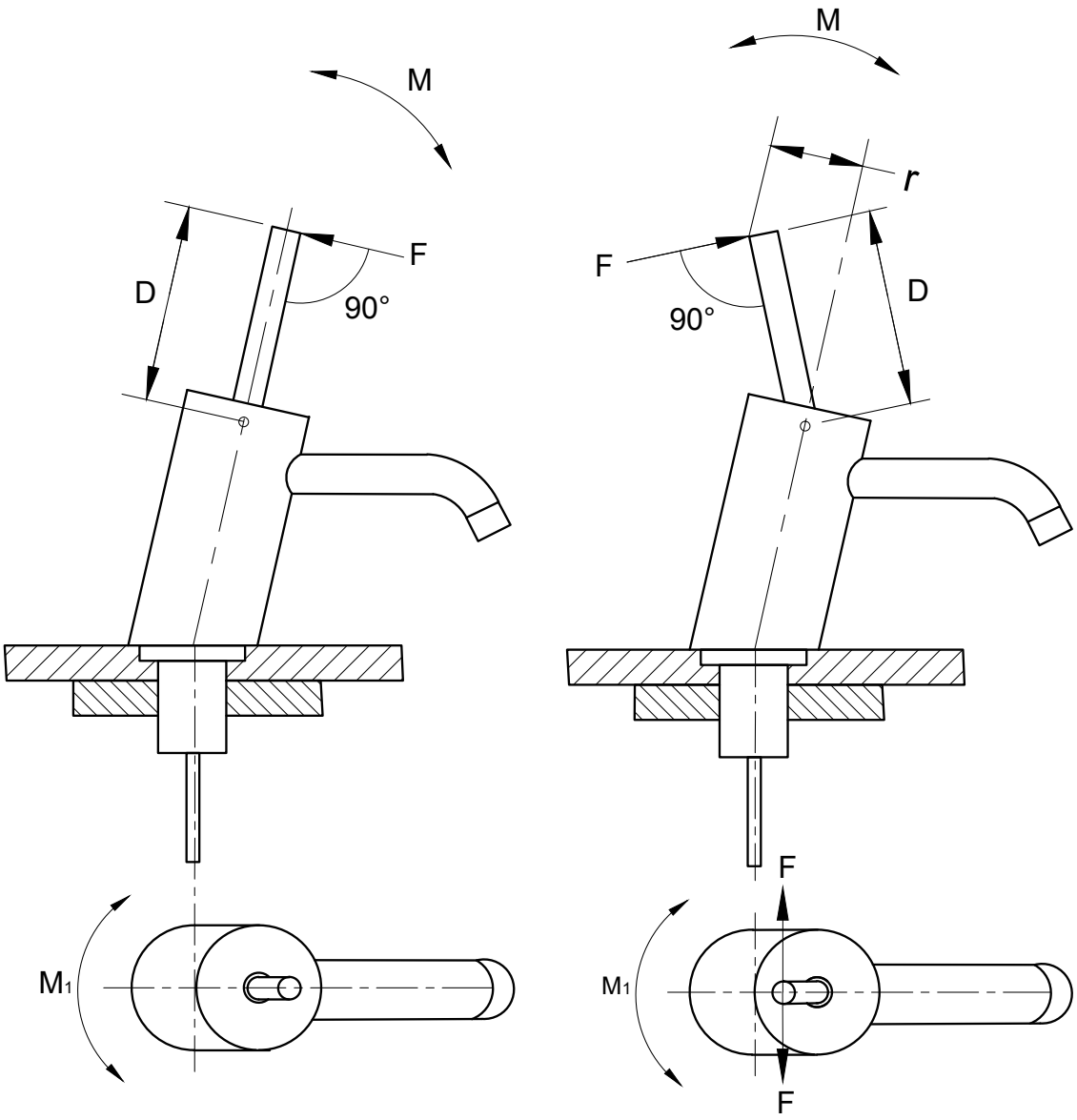


FIG. 19 TEST BENCH ADJUSTMENT TORQUE FOR JOYSTICK MIXING VALVE

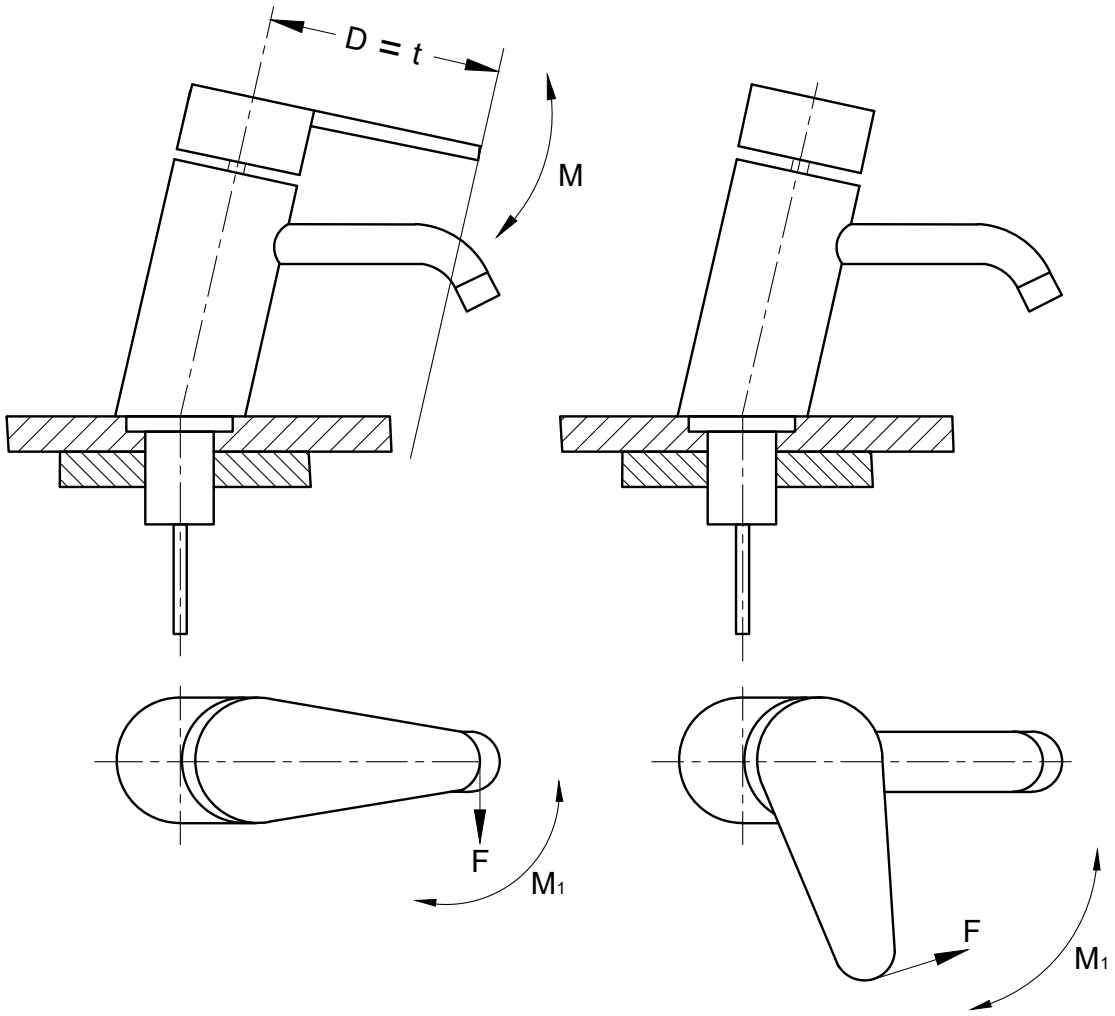


FIG. 20 TEST ADJUSTMENT TORQUE FOR MIXING VALVE

e) Subject the mixing valve to 70 000 cycles of opening and closing, each cycle comprising opening and closing movements as described below and illustrated in Fig. 17 to Fig. 20:
   1) *For rectangular movements*:
      i) start in mean mixed closed position;
      ii) open in mean mixed position;
      iii) return to closed position;
      iv) move to cold water position (position 3);
      v) open in cold water position (position 4);
      vi) move to full open hot water position (position 5), then dwell for 5 s.;
      vii) move to cold water position (position 6), then dwell for 5 s.;
      viii) close in cold water position (position 7);
      ix) move to closed hot water position (position 8);
      x) open in hot water position (position 9), then close (position10); and
      xi) return to position 0.
   2) *For triangular movements*:
      i) start in mean mixed closed position;
      ii) open in mean mixed position;
      iii) return to closed position;
      iv) open in full cold water position;
      v) move to full hot water position, then dwell for 5 s.;

vi) move to full cold water position, then dwell for 5 s.;

vii) return to mixed closed position (position 6);

viii) open in full hot water position; and

ix) close, return to position 0.

3) For dual control, subject each control device to the relevant part of the rectangular movement series of tests.

where,

F = applied force, in N;

D = radius of control lever, in mm;

r = effective radius of control lever, in mm;

M = moment, in Nm

($M = F \cdot D/1\ 000 \leq 3$ Nm) ; and

M_1 = moment, in Nm

($M_1 = F \cdot r/1\ 000 \leq 3$ Nm).

for example,

a) If D = 100 mm, then F has to be 30 N.

b) If D = 50 mm, then F has to be 60 N.

E-2.3 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 Nm during the test.

Verify that, after 70 000 cycles, the leak tightness requirements of **B-3** and **B-4** are still satisfied.

During the test, record any incident, such as, failure of leak tightness, leakage in the assembly, fracture of components, stoppage of machine due to control difficulties, etc.

E-3 MECHANICAL ENDURANCE OF DIVERTER FOR BATH AND SHOWER MIXERS

E-3.1 General

These two methods, one for manual diverters and the other for diverters with automatic return, shall be carried out to evaluate the mechanical endurance of diverters of combination taps, and specifies the test criteria.

The diverter assembly should hold at a minimum water pressure of 0.05 MPa.

E-3.2 Test Method

E-3.2.1 *Principle*

The diverter is subjected to a specified number of operations whilst being supplied alternately with cold water and with hot water to test its behaviour over a period of time, taking into account the effect of water temperature (*see* Table 18).

E-3.2.2 *Apparatus*

E-3.2.2.1 *Manual diverter*

An automatic machine that ensures alternate operations at the rate of (15 ± 1) cycles per minute and supply circuits with a pump or similar device to supply the required cold water static pressure at a temperature of ≤ 30 °C and the required hot water static pressure at a temperature of (65 ± 2) °C.

E-3.2.2.2 *Diverter with automatic return*

A mechanism for moving the diverter to the shower position under the conditions specified in **B-5** and supply circuits identical to those specified above with, in addition, an automatic quick-acting valve to cut off the supply to the combination tap/mixer under test.

Table 18 Summary of Endurance Test Conditions for Diverters

(*Clause* E-3.2.1)

Sl No.	Conditions	Field of Application Supply System
(1)	(2)	(3)
i)	Pressure of cold or hot water, in MPa	(0.4 + 0.05)
ii)	Water temperature, in °C	
	a) Cold water	≤ 30
	b) Hot water	(65 ± 2)
iii)	Timing of supply of cold or hot water, in min	15 ± 1
iv)	Time of flow to bath or to shower outlet, in s	5 ± 0.5
v)	Flow rate to bath and to shower outlet, in *l*/min	(6 ± 1)
vi)	Operation rate for manual diverters (cycles), in min^{-1}	15 ± 1
vii)	Number of cycles	30 000

E-3.2.3 *Procedure*

E-3.2.3.1 *Manual diverter*

a) Install the tap, as supplied, onto the test rig and connect both inlets to both supply circuits;

b) connect the drive device to the diverter operating member by means of a flexible component;

c) adjust the static water pressure of both hot and cold circuits for taps to (0.4 ± 0.05) MPa;

d) in the flow-to-bath and flow-to-shower mode, adjust the flow rate to (6 ± 1) *l*/min by restricting the outlet; and

e) subject the diverter to a test of 30 000 cycles, each comprising a return movement between the extreme positions; throughout the test, supply the tap alternately at both inlets with cold water for (15 ± 1) min then hot water for (15 ± 1) min.

E-3.2.3.2 *Diverter with automatic return*

a) Install the tap, as supplied, on the test rig and connect both inlets to both supply circuits;

b) Connect the drive device to the diverter operating member by means of a flexible component;

c) Adjust the static pressure of both hot and cold circuits for taps to (0.4 ± 0.05) MPa;

d) In the flow-to-bath and flow-to-shower mode, adjust the flow rate to (6 ± 1) l/min by restricting the outlet; and

e) Subject the diverter to a test of 30 000 cycles, one cycle being defined as follows:

   1) with the diverter in the "flow to bath" position, allow water to flow through the bath outlet for (5 ± 0.5) s;

   2) move the diverter to the shower position;

   3) allow water to flow through the shower outlet for (5 ± 0.5) s; and

   4) use the quick-acting valve to cut off the supply to the tap, allowing the diverter to return to the "flow to bath" position, and then reopen the supply.

Throughout the test, supply the tap alternately at both inlets with cold water for (15 ± 1) min and then hot water for (15 ± 1) min.

E-3.2.4 *Requirement*

Throughout the test, there shall be no incidents of leaks, failure of diverter to reset, blockage, etc.

On completion of 30 000 cycles the assembly shall be leak tight when tested according to **B-5** for manual diverters or **B-5.3** for diverters with automatic return.

ANNEX F

(*Clause* 12)

SAMPLING AND CRITERIA FOR CONFORMITY

F-1 SCALE OF SAMPLING

F-1.1 Lot

In any consignment, all the items (pillar taps, bib taps, combination tap assemblies, stop valves and angle stop valves and single lever mixers) made of the same material, of the same nominal size and from the same batch of manufacture shall be grouped together to constitute a lot.

F-1.2 For ascertaining the conformity of material in the lot to the requirements of this standard, sample shall be tested from each lot separately.

F-1.3 The number of items to be selected from the lot shall depend on the size of the lot and shall be according to Table 19.

Table 19 Scale of Sampling and Criteria for Conformity

(*Clause* F-1.3)

Sl No.	No. of Taps and Valves in the Lot	Sample Size	Acceptance Number	Sub-Sample
(1)	(2)	(3)	(4)	(5)
i)	Up to 150	8	0	8
ii)	151 to 300	13	0	13
iii)	301 to 500	20	1	13
iv)	501 to 1 000	32	2	20
v)	1 001 to 3 000	50	3	32
vi)	3 001 and above	80	5	32

F-1.3.1 These items shall be selected at random from the lot, in order to ensure randomness of selection, procedures given in IS 4905 may be followed.

F-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

F-2.1 All the taps and valves selected according to **F-1.3** shall be examined for material (**5.1**), manufacture, workmanship and construction (**6**), dimensions (**7**), and finish (**9**). For accessible taps, the requirements given in **8** shall also be examined. A sample item failing to satisfy one or more of these requirements shall be considered as defective.

F-2.1.1 The lot shall be considered to have satisfied these requirements if the number of defective items found in the sample is less than or equal to the corresponding acceptance number given in col 4 of Table 19.

F-2.2 The lot having been found satisfactory according to **F-2.1** shall be further tested for performance test specified under **9.2**. For this purpose, a sub-sample of taps and valves given in col 5 of Table 19 shall be taken and subjected to these tests. The number of items required in the sub-sample may be taken from those already examined and found satisfactory according to **F-2.1**.

F-2.2.1 The lot shall be considered to have satisfied the requirements for these tests if none of tap and valves in the sub-sample fails in any of these tests.

ANNEX G

(*Foreword*)

COMMITTEE COMPOSITION

Sanitary Appliances and Water Fittings Sectional Committee, CED 03

Organization	*Representative(s)*
Municipal Corporation of Greater Mumbai, Mumbai	Hydraulic Engineer (Shri A. S. Rathore) (***Chairman***)
Brihan Mumbai Licensed Plumbers' Association, Mumbai	Shri Kishor V. Merchant Shri Bijal M. Shah (*Alternate*)
Building Materials and Technology Promotion Council, New Delhi	Shri S. K. Gupta Shri C. N. Jha (*Alternate*)
Capstan Meters (India) Ltd, New Delhi	Shri Anurag Jaipuria Shri P. K. Jaipuria (*Alternate*)
Central Institute of Plastic Engineering and Technology, Chennai	Dr B. Srinivasalu Shri K. Prakalathan (*Alternate*)
Central Public Works Department, New Delhi	Shri M. K. Mallick Shri Divakar Agrawal (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Shri Ajay Chaurasia Shri Rajiv (*Alternate*)
Consumer Co-ordination Council, Delhi	Shri A. L. Saaha Shri S. C. Sharma (*Alternate*)
Delhi Development Authority, New Delhi	Chief Engineer (Design)
Delhi Jal Board, New Delhi	Chief Engineer (WW) II Superintending Engineer (NW) (*Alternate*)
Engineers India Ltd, New Delhi	Shri Samir Das Shri Rajesh Gujral (*Alternate* I) Shri Anish Mahala (*Alternate* II)
Geberit Plumbing Technology (India) Pvt Ltd, Bengaluru	Representative
Goverdhan Das P. A. (Calcutta), Kolkata	Shri J. R. Aggarwal Shri Sanjay Raj Aggarwal (*Alternate* I) Shri Rohan Aggarwal (*Alternate* II)
HSIL Ltd, Bahadurgarh	Dr R. K. Somany
Indian Water Meter Manufacturers Association, New Delhi	Shri M. P. Jaipuria Shri S. K. Bohra (*Alternate*)
Indian Water Works Association, New Delhi	Shri Vijay B. Charhate Shri Gurunath M. Naik Parikar (*Alternate*)
Institution of Public Health Engineers, Kolkata	Shri M. M. Datta Shri Sitansu Banerjee (*Alternate*)
Itron India Pvt Ltd, New Delhi	Shri Pawan Mathur Shrimati Kalpana Bhaskar (*Alternate*)
Military Engineer Services, Engineer-in-Chief's Branch, Integrated HQ of MoD (Army), New Delhi	Shri Somesh Kumar Shri M. K. Deepak (*Alternate*)
Municipal Corporation of Greater Mumbai, Mumbai	Dy Hydraulic Engineer Executive Engineer (Planning) (*Alternate*)

Organization	*Representative(s)*
National Test House, Kolkata	Dr P. Kanjilal Shri D. V. S. Prasad (*Alternate*)
NBCC (India) Limited, New Delhi	Shri H. S. Yadav Shrimati Annu Garg (*Alternate*)
Northern Railway, New Delhi	Chief Engineer (P & D)
Plastindia Foundation, Mumbai	Representative
Research Designs and Standards Organization, Lucknow	Representative
Roca Bathroom Products Pvt Ltd, Chennai	Shri Ankit Dilliwal Shri Mukesh Kumar Jain (*Alternate*)
Tata Consulting Engineers Ltd, Mumbai	Representative
Voluntary Organization in Interest of Consumers Education, New Delhi	Shri Hemant Kumar
In Personal Capacity (*B-58 A, Gangotri Enclave, Alaknanda, New Delhi 110019*)	Shri J. D' Cruz
In Personal Capacity (*A-404, Milan Chs, Veeradessai Road, Andheri, Mumbai 400058*)	Shri T. R. Rane
BIS Directorate General	Shri Sanjay Pant, Scientist 'F' and Head (Civil Engineering) [Representing Director General (*Ex-officio*)]

Member Secretary

Shrimati Madhurima Madhav
Scientist D (Civil Engineering), BIS

Domestic Water Fittings Subcommittee, CED 3 : 2

Organization	*Representative(s)*
Delhi Jal Board, New Delhi	Shri Praveen Bhargava (***Convener***)
Bangalore Water Supply and Sewerage Board, Bangalore	Shri T. Venkataraju Shri V. Mahesh (*Alternate*)
Brihan Mumbai Licensed Plumbers' Association, Mumbai	Shri Kishor V. Merchant Shri Bijal M. Shah (*Alternate*)
Building Materials & Technology Promotion Council, New Delhi	Shri D. P. Singh Shri S. K. Gupta (*Alternate*)
Central Public Health Environmental Engineering Organization, New Delhi	Shri J. B. Ravindra Shri Satish Mane (*Alternate*)
Central Public Works Department, New Delhi	Shri M. K. Mallick Shri Divakar Agrawal (*Alternate*)
Commander Watertech Pvt Ltd, Mumbai	Shri Jimmy Parikh Shri Prafulla Sonawane (*Alternate*)
CSIR-Central Building Research Institute, Roorkee	Shri Ajay Singh Shri S. K. Gupta (*Alternate*)
Delhi Jal Board, Delhi	Chief Engineer (WW) II Superintending Engineer (NW) (*Alternate*)

Organization	*Representative(s)*
Gem Sanitary Appliances Pvt Ltd, New Delhi	Shri B. K. Singhal Shri Ameesh Singhal (*Alternate*)
Govardhan Das P. A. (Calcutta), Kolkata	Shri Joginder Raj Aggarwal Shri Sanjay Aggarwal (*Alternate*
HSIL Ltd, Bahadurgarh	Dr R. K. Somany Shri R. P. Srivastava (*Alternate*)
Indian Plumbing Association, New Delhi	Shri Subhash Deshpande Shri Mahesh Pathak (*Alternate*)
Institute of Public Health Engineers Kolkata	Shri Murari Mohan Dutta
Karnataka Water Supply and Drainage Board, Bengaluru	Shri T. Thimme Gowda Shri R. Rangaswamy (*Alternate*)
Ministry of Railways, New Delhi	Shri R. G. Singh
Municipal Corporation of Greater Mumbai, Mumbai	Hydraulic Engineer Dy Hydraulic Engineer (*Alternate*)
National Test House, Kolkata	Shri S. P. Roy Shri Aloke Dey (*Alternate*)
Pune Municipal Corporation, Pune	Representative
Punjab Valves and Cocks Mfrs Association, Jalandhar	Shri Vijay K. Kumar Shri Nitin K. Kumar (*Alternate*)
Rajiv Gandhi National Drinking Water Mission, New Delhi	Shri D. Rajasekhar
Roca Bathroom Products Pvt Ltd, Dewas	Shri Ankit Dilliwal Shri Mukesh Kumar Jain (*Alternate*)
Sant Valves Pvt Ltd, Jalandhar	Shri Ramesh Kumar Sammi Shri Kunwar Sunil Kumar (*Alternate*)
Tamil Nadu Water Supply and Drainage Board, Chennai	Joint Chief Engneer (PDC) Dy Chief Engineer (O&M) (*Alternate*)

Panel for Formulation of Standards for Requirements for Water Efficient Plumbing Products, CED 3 : P1

Organization	*Representative(s)*
HSIL Ltd, Bahadurgarh	Dr R. K. Somany (***Convener***)
Bathline India Pvt Ltd, New Delhi	Shri Vinay Gupta
Brihan Mumbai Licensed Plumbers' Association, Mumbai	Shri Kishore V. Merchant Shri B. M. Shah (*Alternate*)
Central Public Health and Environmental Engineering Organization, New Delhi	Representative
Centre for Science and Environment, New Delhi	Dr Suresh Kumar Rohilla
Cera Sanitaryware Limited, Ahmedabad	Shri Bhushan Yerpude Shri Bhavik Patel (*Alternate*)
Delhi Jal Board, New Delhi	Shri Ajay Kumar Gupta
Fluid Control Research Institute, Palakkad	Shri Gopan C. K.
Gem Sanitary Appliances Pvt Ltd, New Delhi	Shri B. K. Singhal

Organization	*Representative(s)*
HSIL Ltd, Bahadurgarh	Shri K. N. Jha Shri Ajay Jain (*Alternate*)
Indian Green Building Council, Hyderabad	Shri S. Karthiyeyan Shri Punit Agarwal (*Alternate*)
Indian Plumbing Association, New Delhi	Shri B. S. A. Narayan Shri H. R. Ranganath (*Alternate*)
Jaquar & Company Pvt Ltd, Gurugram	Shri Mohan Sharma Shri Yashwant Gupta (*Alternate*)
MKG Consultants, New Delhi	Shri M. K. Gupta
Municipal Corporation of Greater Mumbai, Mumbai	Shri N. D. Shinde Shri U. S. Mudras (*Alternate*)
Municipal Corporation of Gurugram, Gurugram	Representative
National Water Mission, Department of Water Resources, River Development & Ganga Rejuvenation, Ministry of Jal Shakti, New Delhi	Shri Suneel Kumar Arora
Neoperl India Pvt Ltd, Gurugram	Shri Naveen Vatsa
NSF Safety and Certification India Private Limited, Gurugram	Shri B. B. Singh
Proion Consultants, New Delhi	Shri Sandeep Goel
Roca Bathroom Products Pvt Ltd, Chennai	Shri Ankit Dilliwal Shri Mukesh Jain (*Alternate*)
Sloan India Private Limited, Gurugram	Shri Anup Kumar Tripathi Shrimati Deepika Kaushal (*Alternate*)
Superflo Pvt Ltd, Hyderabad	Maj Gen Ram Partap
Vandana Menon Architects, New Delhi	Shrimati Vandana Menon
In personal capacity (*A-1202, Marvel Azure Sade Satrah Nali Road, Pune 411028)*	Shri R. P. Srivastava

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