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பொதுசனக் கருத்துரைக்கான கட்டளை வரைவு
DRAFT STANDARD FOR PUBLIC COMMENT

(වෙනස්විමට ඉඩ ඇත. திருத்தத்திற்குட்படக்கூடியது. Liable to alteration)

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Draft Sri Lanka Standard Specification for Globe Valves used for Water Supply in Buildings

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இவ்வரைவு இலங்கைக் கட்டளையெனக் கருதப்படவோ அன்றிப் பிரயோகிக்கப்படவோ கூடாது
This draft should not be regarded or used as a Sri Lanka Standard.

අදහස් එවිය යුත්තේ : ශ්‍රී ලංකා ප්‍රමිති ආයතනය, 17, වික්ටෝරියා පෙදෙස, ඇල්විටිගල මාවත, කොළඹ 08.

Comments to be sent to: SRI LANKA STANDARDS INSTITUTION, 17, VICTORIA PLACE,
ELVITIGALA MAWATHA, COLOMBO 08.

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Introduction

This Draft Sri Lanka Standard has been prepared by the Sri Lanka Standards Institution and is now being circulated for technical comments to all interested parties.

All comments received will be considered by the SLSI and the draft if necessary, before submission to the Council of the Institution through the relevant Divisional Committee for final approval.

The Institution would appreciate any views on this draft which should be sent before the specified date. It would also be helpful if those who find the draft generally acceptable could kindly notify us accordingly.

All Communications should be addressed to:

The Director General
Sri Lanka Standards Institution,
17, Victoria Place,
Elvitigala Mawatha,
Colombo 08.

DRAFT SRI LANKA STANDARD

SPECIFICATION FOR GLOBE VALVES USED FOR WATER SUPPLY IN BUILDINGS

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Gr.

SRI LANKA STANDARDS INSTITUTION
17, Victoria Place
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Sri Lanka.

DRAFT SRI LANKA STANDARD
SPECIFICATION FOR GLOBE VALVES USED FOR WATER SUPPLY IN BUILDINGS

FOREWARD

This standard was approved by the Sectoral committee on Materials, Mechanical Systems and Manufacturing Engineering and was authorized for adoption and publication as a Sri Lanka standard by the council of the Sri Lanka Standards Institution on ……………….

As observed by the National Water Supply and Drainage Board of Sri Lanka, about thirty percent (30%) of the domestic water supply is wasted due to leakages through substandard water accessories. Therefore, it is essential to have the water accessories standardized. Consequently, a policy decision has been taken by the government to introduce the standards for water accessories. As a part of this effort, the standard herein provides specifications for copper alloy and stainless steel ball valves used for potable water supply systems.

Guideline for the determination of compliance of a lot with the requirements of this standard based on statistical sampling and inspection are given in Appendix **A**.

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 an analysis shall be rounded off in accordance with SLS 102. The number of significant places retained in the rounded off value shall be the same as that of the specified value in this standard.

In the preparation of this standard, the assistance derived from the **EN 1213**, a publication of the European Committee for Standardization, is gratefully acknowledged.

1. SCOPE

This standard specifies the requirements of materials, design parameters, mechanical and hydraulic characteristics to be maintained in construction and operation of globe valves.

This further specifies test methods for verification of the design, construction and performance parameters and marking requirements.

This standard applies only for globe vales with the following features.

- manually operated or with provisions for manual operation in a motorized configuration;
- body made out of copper alloys or stainless steel;
- nominal sizes DN 8 to DN 50 or nominal sizes expressed as per designation of “NPS” or “A” in equivalent to DN 8 to DN 50 (Annex B);
- pressure rating up to PN 16;
- recommended for the use in potable water (as defined in SLS 614: 2013) services;
- recommended operating water temperature up to 60^0C

2. REFERENCE

ISO 6708:	Pipework components – Definition and selection of DN (nominal size)
ISO 5208:	Industrial valves — Pressure testing of metallic valves
ISO 815-1	Rubber, vulcanized or thermoplastic --Determination of compression set – Part 1: At ambient or elevated temperatures
ISO 48-	Rubber, vulcanized or thermoplastic. Determination of hardness. Indentation hardness by durometer method (Shore hardness)
ISO 868:	Plastics and ebonite. Determination of indentation hardness by means of a durometer (Shore hardness)
ISO 2768-1:	General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications
ISO 2768-2:	General tolerances – Part 2: Geometrical tolerances for features without individual tolerance indications
ISO 228-1:	Pipe threads where pressure-tight joints are not made on the threads. Dimensions, tolerances and designation
ISO 7-1:	Pipe threads where pressure-tight joints are made on the threads – Part 1: Dimensions, tolerances and designation
ISO 4185:	Measurement of liquid flow in closed conduits — Weighing method

BS EN 1074-1	Valves for water supply. Fitness for purpose requirements and appropriate verification tests; Part 1- General requirements
BS EN 1074-2	Valves for water supply. Fitness for purpose requirements and appropriate verification tests; Part 2- Isolating valves
BS 6920-1	Suitability of non-metallic materials and products for use in contact with water intended for human consumption with regard to their effect on the quality of the water.
ASTM D 2240-15:	Standard Test Method for Rubber Property—Durometer Hardness
ASTM D 395-03:	Standard Test Methods for Rubber Property—Compression Set
BS EN 681-1	Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Vulcanized rubber

3. TERMS AND DEFINITION

For the purpose of this standard, the following definitions shall apply.

3.1. Globe Valve:

Globe valves are linear motion closing-down valves in which the closure member is moved squarely on and off the seat.

3.2. Nominal Diameter “DN”:

An alphanumeric designation of size for components of a pipework system, which is used for reference purposes. It comprises the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimeters, of the bore or outside diameter of the end connections.

3.3. Nominal Size of “A” :

It is an alphanumeric designation of size for reference purposes. The letter “A” is followed by a dimensionless whole number. The number is indirectly related to the physical size in millimeters of the bore or outer diameter of the end connections.

3.4. Nominal Size of “NPS”:

The letters, NPS stand for Nominal Pipe Size. It is an alphanumeric designation of size for reference purposes. It comprises the letters NPS followed by a dimensionless whole number which is indirectly related to the physical size in inches of the bore of the end connections.

3.5. Allowable operating pressure (PFA):

Maximum hydrostatic pressure that a component is capable of withstanding continuously in service

3.6. Maximum allowable pressure (PMA):
Maximum pressure occurring from time to time, including surge, that a component is capable of withstanding in service (EN 805)

3.7. Allowable site pressure (PEA):
Maximum hydrostatic that a newly installed component is capable of withstanding for a relatively short duration, in order to ensure integrity and tightness of the pipeline (EN 805).

3.8. Allowable Differential pressure:
Maximum allowable static differential pressure at a given temperature of a valve when it is in the closed position.

3.9. Maximum Operating Torque (MOT):
The higher value (limit) fixed for the operating torque which, when applied to operating device, will operate the valve and ensure the compliance with the required leakage rate.

3.10. Strait pattern body:
Body having two body end ports where the axis of the bonnet or cover is parallel to the face of the body end ports.

3.11. Angle pattern body:
Body having two body end ports and where the faces are right angle each other.

3.12. Oblique pattern body:
Body having two body end ports and where the axis of the bonnet or cover is not parallel to the faces of the body end ports.

3.13. Lug type body:
Body design with threaded or unthreaded hole for bolting adjacent connecting pipe or flange.

3.14. Wafer type body:
Body designed to be installed by clamping between two flanges.

3.15. Capillary end:
Body end prepared for connection to a tube by soldering or brazing.

3.16. Compression end:
Body end prepared for connection to a tube by the compression ring or sleeve on the outside surface of the tube by a clamping nut.

3.17. Loose nut end:
Body end provided with a tailpiece which retains a loose female threaded nut or a ring having male thread for connection to the mating component.

3.18. Union End:
Body end provided with an external threaded portion to which is attached a threaded nut or ring, which retains a tail piece for connection to the mating component.

4. DESIGNATION

The valve shall be designated to be able to identify its unique features as described below.

a) Application
b) Pressure rating
c) Type
d) Material
e) Nominal size
f) End connection

The designation of the valve shall be specified by the manufacturer in the technical catalogue using suitable codes or numbers.

Example:

Application : Potable water (PW)
Valve type : Straight pattern (SP)
Body material : Copper alloy (CA)
Nominal size : DN25
Nominal pressure : PN16
End connection : Rp1 thread (Rp1)

The designation of the above specification using suitable codes or numbers is given in Figure 1.

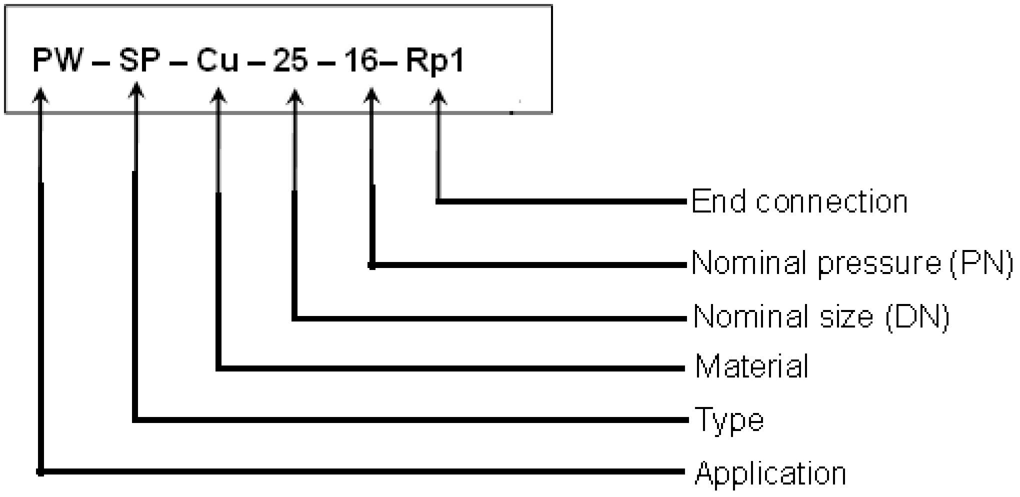


Figure 1 – An example designation of a globe valve using codes and numbers

5. CLASSIFICATION

5.1 Product Description

A Globe valves is a linear motion valve and are primarily designed to stop, start and regulate the flow. It is comprised of a movable disc (obturator) integrated with a stem and a stationary ring seat in a confined body.
The globe valves are in different configurations with regard to shape of the body parts, and the way of moving the stem with the obturator, with respect to the stationary valve seat. Categorization of globe valves based on their construction features are given in Appendix **C**.

5.2 Product Classification

The valves covered under this standard are classified into three categories taking in to consideration their designations of nominal size and pressure rating. One category includes nominal size of the valve designated by DN number combining with pressure rating by PN number. Refer Appendix **B**.

6. REQUIREMENTS

6.1 Materials

The materials and coatings used for the product shall not contaminate or change the quality of potable water, in concern with flavour, appearance, odour and toxicity due to leaching, oxidization or any chemical reaction and growth of aquatic microorganisms, when the product is in contact with potable water up to an elevated temperature of 60 ^{0}C and accidental contact up to a temperature of 90 ^{0}C for a maximum period of 1 hour.

Materials of the body and ball of the globe valves covered under this standard shall be manufactured by copper-zinc, copper-tin alloys or stainless steel and may be coated with a suitable material. The manufacturer shall declare in the technical specification sheet of the valve, which materials are used for the valve body and the ball, following a standard material designation.

The material designations shall be specified in accordance with **ISO 1190** or **EN 1412**. If materials are designated using any other standard, the manufacturer shall furnish relevant reference documents describing the designations used.

6.1.1 *Copper Alloys*

Recommended types of copper alloys to be used for the construction of the body and the ball of valves are specified in Table 1. The chemical composition is determined using the Spectrometric methods as specified in **ISO /TR 9769**.

Table 1- Recommended Copper Alloys

Material designation		**Reference standard for material designation**
Symbol	**Number**	
(1)	**(2)**	**(3)**
CuSi4Zn4MnP-C	CC245E	SLS EN 12168
CuSi4Zn9MnP-C	CC246E	SLS EN 12168
Cu Sn 10-C	CC480K	SLS EN 1982
CuSn5Zn5Pb5-C	CC491K	SLS EN 1982
CuSn3Zn8Pb5-C	CC490K	SLS EN 1982
CuSn5Zn5Pb2-C	CC499K	SLS EN 1982
CuZn21Si3P	CC768S	SLS EN 12164
CuZn39Pb1Al-C	CC757S	,,
CuZn36PbPb-C	CC770S	,,
CuZn38AsSb	CC771S	,,
CuZn36Pb1.5AsSbAl	CC772S	,,
CuSn8	CW453K	,,
CuZn40	CW509L	,,
CuZn42	CW510L	,,
CuZn38As	CW511L	,,
CuZn30As	CW707R	,,
CuZn21Si3P	CW724R	,,
CuZn33Pb1AlSiAs	CW725R	,,
CuZn10	CW501L-DW	,,
CuZn33	CW506L-DW	,,
CuZn36	CW507L-DW	,,
CuZn37	CW 508L-DW	,,
CuZn36Pb3	CW603N	,,
CuZn39Pb2	CW612N	,,
CuZn39Pb3	CW614N	SLS EN 12164
CuZn40Pb2	CW617N	SLS EN 12420
CuZn35Pb1.5AlAs	CW625N	,,
CuZn33Pb1.5AlAs	CW626N	,,

Amount of constituents in Copper alloys used to manufacture any component of the valve shall be less than the limits specified in Table **2** below.

Table 2: Limits of the constituents of the copper alloys

Substance	**Maximum % by weight of total metal**
(1)	**(2)**
Lead (Pb)	3.5
Zinc (Zn)	10.0
Aluminium (Al)	8.0

Copper-Zinc alloys containing more than 10% zinc are subject to dezincification if operated with potable water capable of dezincification. The valves containing more than 10% zinc have to guarantee a dezincification depth less than 200µm in any direction, when tested in accordance with ISO 6509 and have to be marked in compliance with the indication in clause **8**.

6.1.2 *Stainless Steel*

*St*ainless steel materials used to manufacture any component of the valve shall be of Austenitic or Duplex grade, which constitutes the chromium (Cr) content of 16% or more by weight. Recommended stainless steel materials are given in Table **3**.

Table 3- Recommended Stainless steel materials

Material Designation		**Raw Material Standard**
Symbol (EN/ISO)	**EN Number**	
(1)	**(2)**	**(3)**
X6CrNiMoTi17-12-2	1.4571	SLS EN 10213-4
X5CrNiMo17-12-2	1.4401	SLS EN 10213-4
X2CrNiMo17-12-2	1.4404	SLS EN 10272
GX5CrNiMoNb19-11-2	1.4581	SLS EN 10272
GX5CrNiMo19-11-2	1.4408	SLS EN 10272

6.1.3 *Non-Metallic Materials*

The constitutes or impurities of the non-metallic materials used in construction of the valve shall not make any effect on deteriorating potable water intended for human consumption in concern with growth of aquatic microorganisms and toxicity due to leachate of the constitute or impurities into water, in the form of dissolving or suspending particles in potable water.

6.1.3.1 Growth of aquatic microorganisms

When a product is examined by the method given in Appendix **D**, it shall be deemed not to support appreciable microbial growth if the mean dissolved oxygen difference (MDOD) is 2.39 mg/l or less.

If a single sample of a product gives an MDOD value that is greater than 1.69 mg/l but not more than 2.9 mg/l, then two further samples of the product shall be examined. If the arithmetic mean of the three MDOD values obtained is 2.39 mg/l or less, then the product shall again be regarded as not being capable of supporting an appreciable microbial growth when in contact with water intended for human consumption.

6.1.3.2 Toxicity due to leachate of metals

When tested in accordance with Annex D, in this standard, the product shall be deemed suitable for contact with water intended for human consumption if the amounts of the specified metals in the final extracts do not exceed the specified limits given in Table **04** shown below.

If the limit for any metal is exceeded in either of the final extracts, then the product shall be deemed unsuitable for contact with water intended for human consumption unless a further three untested samples are tested and the amounts of the specified metals in all of the further final extracts do not exceed the limits specified in Table **4**.

Table 4 — Maximum allowable concentrations of metals specified in the standard

Metal	**Maximum allowable Concentrations µg/l**
(1)	**(2)**
Aluminium	200
Antimony	10
Arsenic	50
Barium	1000
Cadmium	5
Chromium	50
Iron	200
Lead	50
Manganese	50
Mercury	1
Nickel	50
Selenium	10
Silver	10

NOTE 1: The significance of results that conform to the specified limits in Table 04 in the seventh test extracts, but exceed the limits in the first extracts may be assessed by the SLSI as National Regulator.

NOTE 2: The National Regulator may also specify analysis for other metals and assess the results obtained.

When a metal fitting has been used in the testing of a product, the assessment shall be made on the differences in concentrations of the specified metals between the final extracts and the metal fitting blank test. If the results from the first 24 h extracts conform to the limits in Table **4**, then the first extracts shall be defined as the final extracts.

6.1.4 *Type of Materials to be used*

6.1.4.1 Body and disc

Material of the body shall be copper alloy specified in clause **6.1.1** or stainless steel specified in clause **6.1.2**. In any case material of the ball is made of other type of steel it shall be chromium plated or plastic coated satisfied to the material requirements specified in this standard. If the ball is made of special steel without having chromium plating or plastic coating the manufacturer shall prove the all material requirements specified in this standard.

6.1.4.2 Stem/Spindle, bonnet, stem nut, gland and stem cap

Material of the stem, stem nut and the cap shall be copper alloy specified in clause **6.1.1** or stainless steel specified in clause **6.1.2.**

6.1.4.3 Operating Wheel / “T”-handle

Material of the wheel or handle shall be copper alloy specified in clause **6.1.1** or stainless steel specified in clause **6.1.2** or chromium plated metal alloy.

6.1.4.4 Sealing materials

Types of sealing non-metallic materials used for valve seats, disc seals, thrust washer, “O”-ring etc shall be vulcanized rubber, Polytetrafluoroethylene (PTFE) or Ethylene Propylene Diene Monomer (EPDM) alone or reinforced form. The stem seal can be compression packing too. Compression packing material shall be PTFE, carbon fiber packing with PTFE impregnation or similar material of non-contaminate potable water.

Sealing materials of vulcanized rubber shall comply with the standard **SLS 1627** or **ISO 4633** or **EN 681-1** and also fulfill the requirements stated in the clause **6.1.3** of this standard.

The properties of PTFE and EPDM tested according to SLS297 and ISO815, shall conform the limits given in the Table 6 below.

The properties of PTFE and EPDM shall be conformed to the values shown in the Table **5** below.

Table 5 - Properties of PTEF and EPDM materials

Material	**Hardness**		**Compression set**	
	Value	**Test method**	**Value**	**Test Method**
(1)	**(2)**	**(3)**	**(4)**	**(5)**
Polytetrafluoroethylene (PTF)	50 to 60 Shore D	SLS 297	≤ 15%	ISO 815 -1 at 23 ^{0}C (type B)
Ethylene Propylene Diene Monomer (EPDM)	60 to 70 Shore A	SLS 297	≤ 25%	ISO 815 -1 at 23 ^{0}C (type B)

6.1.4.5 Other components except cover material of the handle

Other components of the valves such as Joint gasket, assembling nut and bolt etc. shall be manufactured by the materials described in the clauses **6.1.1** to **6.1.3.**

6.1.4.6 Cover material of handle; (if any)

Any type of plastic materials with non- slippery surface finish shall be used.

6.2 End Connections

End connection can be of thread connection, compression fittings, plane end with swivel nut, flange type or lug type in complying with the standards as tabled in Table **6** as shown below.

Table 6 - Types of End connection

Type of end connection	Standard to be conformed
Thread connection ends	Male or female thread of the standard ISO 228-1 Male or female thread of the standard ISO 7-1
Plane ends with swivel nut	Female thread of the standard ISO 228-1
Ends for compression fittings	For connection with plastic pipes, copper tubes and other type of metal tube, the end preparation of the valve shall be in compliance with the standard EN 1254-3, EN 1254-2 and BS 8537 respectively.
Flange ends	Flanged end shall be in compliance with the ISO standard ISO 7005-1 (EN 1092-1)
Lug Type	No standard.

6.2.1 *Threaded End Connection*

Threaded end shall be designed to fulfil two functions in order to perform its intended duty.

Function 1: Facilitating sealing facility when it is installed.
Sealing mechanism can be application of proper sealing media (liquid paste or wrapping tape) around the treads or can be designed to have protruded shoulder (collar) which is to be tighten against the collar of the pipe line/part to be fixed on by entrapping the elastomeric seal.

Function 2: Fixing the valve firmly in the system. (In this standard valve shall be able to fix on the pipe line of portable water supply inside or outside the building.
The product specification of the thread shall be designated as specified in the standard.
Designation of tread conformed to ISO 228-1:

Example:
The size 1½” parallel right hand thread of tolerance class A and tolerance class B shall be designated respectively as follows.

Thread type		Designation
Internal thread	Parallel	Pipe thread ISO 228 - G 1½
External thread	Taper	Pipe thread ISO 228 - G 1½ A
	Always taper	Pipe thread ISO 228 - G 1½ B

Designation of thread conformed to ISO 7-1:

Example:
The complete designation for a right-hand thread size of 1½:

Thread type		Designation
Internal thread	Parallel	Pipe thread ISO 7-R_p 1½
	Taper	Pipe thread ISO 7-R_c 1½
External thread	Always taper	Pipe thread ISO 7-R 1½

If the thread is in left hand rotation it shall be mentioned in the product at least by sticker.

Thread sizes applied to the valves are tabled in Table **7** as shown below.

Table 7 - Thread sizes

Nominal size of the valve							
DN 8	DN 10	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
NPS ¼	NPS ¾	NPS ½	NPS ¾	NPS 1	NPS 1¼	NPS 1½	NPS 2
BSP ¼”	BSP ¾”	BSP ½”	BSP ¾”	BSP 1”	BSP 1¼”	BSP 1½”	BSP 2”

The valves with thread connection shall have at least two parallel protruded flat faces on the body leaving thread portion outside the valve.

6.2.2 *Plane ends with swivel nut*

The plane end shall be prepared so as to entrap the swivel nut by means of projected collar which shall also provide sealing face for making drip-tight joint. Thread dimensions and sizes of the swivel nut can be decided by the manufacturer and shall be described in the product catalogue. Thread type shall be conformed to the standard ISO 228-1.

6.2.3 *Compression End Connection*

If the valve is prepared for compression end connection, the valve shall be accompanied by the required accessories such as olive (compression ring or ferrule and tightening nut. The thread of the nut and the end of the valve shall be in compliance with the specifications specified in the close **6.2.1** in this standard. The end of the valve shall be prepared in order to make drip-tight with the olive and the connecting pipe/tube in complying with SLS EN 1254-2 for copper tubes and SLS EN 1254-3 for plastic pipes.

6.2.4 *Flanged End Connection*

Flange series:
Flange series shall be specified as PN or class.

- If PN series is specified, flanges shall be in accordance with EN 1092-1.
- If class series is specified, flanges shall be in accordance with ANSI/ASME B16.5.

Flange rating designation:
Flange rating designation shall be specified as PN or class with the associated identifying dimensionless number which corresponding to the pressure/temperature rating for the material copper alloy or stainless steel used for the flange of the valve.

1. Flange size:

Flange size designation shall be specified as DN or NPS with the associated identifying dimensionless number that relates to the piping size in which the flange is used.

- If PN series is specified, flange size shall be DN in accordance with EN 1092-1.
- If class series is specified, flange size shall be NPS in accordance with ANSI/ASME B16.5 orANSI/ASME B16.47, as applicable.

In order to ensure interchangeability of the valves in piping system, their face-to-face distance or centre to face distance shall be in accordance with the standard EN 558-1 and bolting hole pitch circle in accordance with EN 1092-1, EN 1092-2 and EN 1092-4 for PN pressure rating flanges.

6.3 Flow passage

The manufacturer shall responsible to design and keep correct size of flow passage through the valve seat by avoiding cavitation due to vena contracta. Manufacturer shall declare the maximum differential pressure allowed for valve usage.

6.4 Operating device

Operation (rotation) of the valve is manual with help of a “T”- handle or wheel attached to the stem directly. The handle shall be detachable from the stem.

6.5 Sealing mechanism of valve seat and disc

The valve seat can be integrated machine surface on the body itself or separated valve seat fixed on the body by screwing. Valve sealing washer/disc shall be fixed on the disc with help of stem or other screwing method.

7. PERFOREMANCE REQUIREMENTS

7.1 Opening, throttling and closing

The globe valve shall close through clockwise multi turn rotation. The valve disc shall be seated on the valve seat drip tightly by mechanical force exerted on interface of thread engagement of the stem. The valve shall be able to throttle for either directions of reducing or increasing flow thorough the valve.

7.2 Operating pressure

Valves covered under this standard which comes under PN designation shall be designed in such a way that their characteristic pressures PFA and PMA conform to values for the corresponding PN rating number given in Table **8** as shown below.

Table 8- Pressure Rating

PN Rating	**PFA***	**PMA***
(1)	**(2)**	**(3)**
6	6 bar	8 bar
10	10 bar	12 bar
16	16 bar	20 bar
* – PFA and PMA apply for all positions of the valve from fully closed to fully open.		

If applicable, de-rating factor for operating pressure against higher operating temperature shall be given by the manufacturer.

7.3 Maximum flow velocity

The valve shall be designed for flow velocities which can reach the values given in Table **9** below in steady flow conditions.

Table 9 - Maximum Flow velocity

PFA (Bar)	**Flow velocity at outlet port (m/s)**
(1)	**(2)**
6	2.5
10	3
16	4

7.4 Mechanical Strength

7.4.1 *Resistance to internal pressure of the shell and all internal components*

The valve body and its components shall be withstand an internal static water pressure applied in partially or fully open position equal to the 1.5 x PFA at static conditions without any mechanical defects such as rupture, cracks or other visible failure or visual leakage.

7.4.2 *Resistance of the obturator to differential pressure*

The valve in closed position shall withstand without any mechanical defects such as rupture, cracks or other visible failure or visual leakage when water pressure applied in upstream port to have differential pressure to the obturator is equal to the lower of two values; (1.5 x PFA) and (PFA + 5 Bar).

7.4.3 *Resistance of valve to operating load (Torque test)*

When torque applied on the operating device as shown in Figure **2**, shall be equal to the values specified in the Table **10** as shown below, for the time period of $30_{0}^{+3}\ s$ the valves shall withstand the stresses due to operating torque.

Table 10- Torque Applied

Nominal size	**DN 8**	**DN 10**	**DN 15**	**DN 20**	**DN 25**	**DN 32**	**DN 40**	**DN 50**
Torque applied (Nm)	5±1	10±1	15±1	20±2	25±2	30±3	30±3	35±3

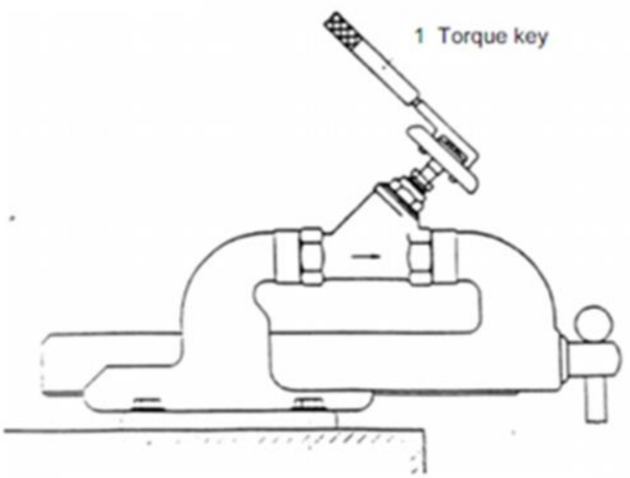


Figure 2- Measuring Operating Torque applied on Operating Device

7.4.4 *Resistance to bending forces on the valve body having threaded end connection*

The valve body with its incorporated parts shall be withstand bending moment exerted due to external force applied perpendicular to the body centre axis via centres of the ports, without impair any functional characteristic. This force can be expected at the time of its installation or undergone to services.

For the purpose of testing and qualifying the valve, the forces applied on the pipe on which the test valve installed as shown in the Figure **3** below, are given in the Table **11.**

Table 11- Bending Moments

Nominal size	**DN 8**	**DN 10**	**DN 15**	**DN 20**	**DN 25**	**DN 32**	**DN 40**	**DN 50**
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Bending moment (Nm)	25	50	75	95	150	190	220	310
Tolerance for all	$^{+10\%}_{0}$							
Distance "a" (mm)	8	10	15	20	25	32	40	50

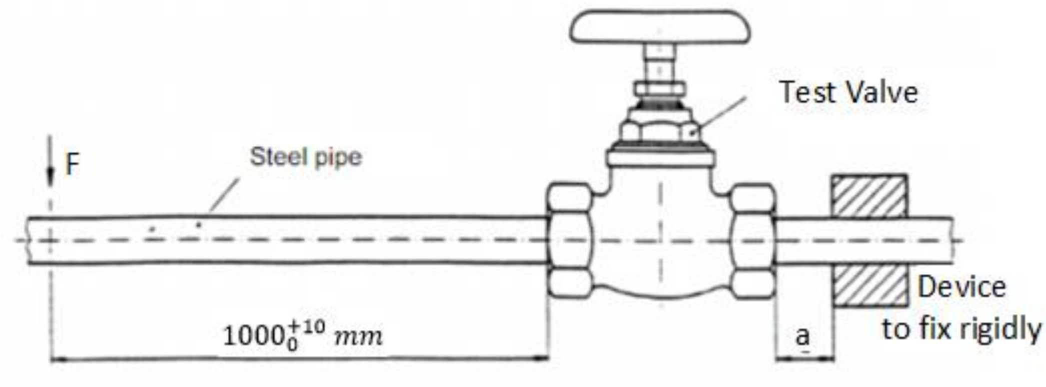


Figure 3- Arrangement for bending moment test of the valve with threaded end

The globe valve shall withstand the applied bending moment for time period of $30^{+3}_{0}\ s$ without fracture or rupture observed visually. And also, any deformation shall not impair the function and leak tightness of the valve.

7.4.5 *Resistance to bending forces on the valve body of DN 50 with flanged ends*

The valves of DN 50 with flanged end connections as specified in the clause **6.2** in this standard, excluding its wafer type of end connection, which are designed to be rigidly installed on supply pipe line, shall withstand the stresses transmitted to the body due to bending moment of 1050 Nm, exerted by external force applied perpendicular to the body centre axis via centres of the ports, as shown in the Figure **4** below, without visual fracture or rupture and, any deformations which shall not impair the function and leak tightness of the valve.

For the purpose of testing and verification of the valve, the force-couple to be applied on the test-valve is shown in Figure **4**, below.

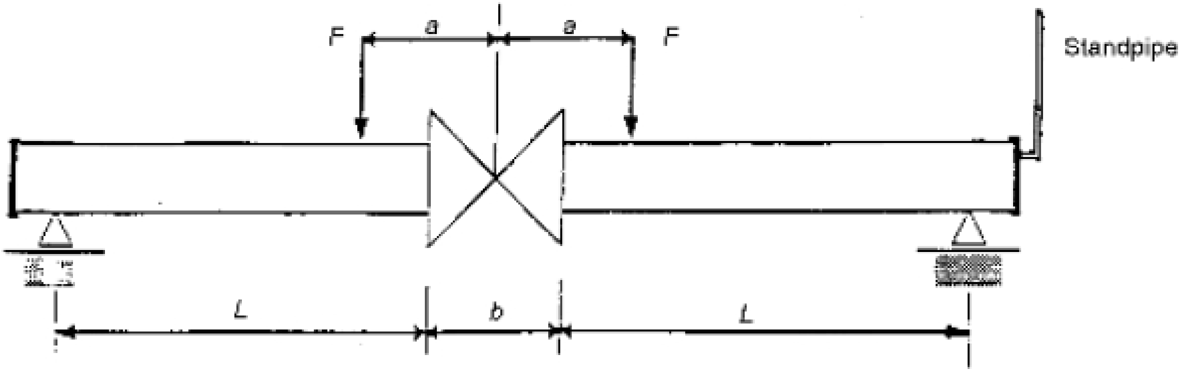


Figure 4- Arrangement for bending moment test of the valve with flanged end

The globe valve shall withstand the applied bending moment, without fracture or rupture observed visually. And also, any deformation shall not impair the function and leak tightness of the valve.

Acceptance criteria:

i. There shall not be visualized any form of water on the body and joints of the components of the valve.

ii. If there is catch-can collection water during the 10 min, the calculated rate of leakage in mm^3/s shall be lower than the specified leakage rate B in the standard SLS EN 12266-2. (i.e. 0.01 x DN – number in mm)

7.5 Leak Tightness

7.5.1 *Leak-tightness of the shell and all internal components to internal pressure*

The valve shall be leak-tight under internal water pressure equal to the 1.5 times PFA.

In order to verify this requirement, the valve in its delivery state is subjected to a water pressure test in accordance with test procedure and method specified in clause **7.8.2.1.**

7.5.2 *Leak-tightness of the assembled valve to external pressure*

The valve shall be leak-tight to ingress of air or water when inside the valve is subjected to vacuum.

In order to verify this requirement, the valve in its open position is subjected to vacuum not less than 0.8 bar in accordance with test procedure and method specified in clause **7.8.2.2.**

7.5.3 *Valve seat tightness to high differential pressure*

The valve shall be withstand to the differential pressure exerted on the ball, at fully close position, equal to the value minimum of 1.1 times PFA without having any leakage through the interface of disc seal and valve seat.

7.5.4 *Valve seat tightness to low differential pressure*

The valve shall be withstand to the differential pressure exerted on the ball at fully close position, equal to the value not higher than 0.5 Bar without having any leakage through the interface of disc seal and valve seat.

7.5.5 Hydraulic Characteristics

Water flow and the flow coefficient of the valve shall be stated by the manufacturer in the product catalogue. When the valve is tested for verification of flow coefficient according to the **SLS EN 1267**, the value obtained by the test shall be greater than "0.9 x Kv value stated by the manufacturer".

Governing equation of the KV is the relationship in the equation given in **SLS EN 1267** as illustrated below.

$$Q = K_v\sqrt{\Delta P}$$

Where Q is the measured volumetric flow rate in m^3/h;

ΔP is the static pressure loss across the valve in bar;
K_V is the flow coefficient in m^3/h per one bar pressure drop across the valve;

7.6 Endurance of the Valves

The valve shall be remained without impair its intended performance after operating the valve for series operation cycles of 10,000 as indicated in test method under clause **7.10**.

For the purpose of determination of conformity of the valve which is designated its nominal size in "DN" or "A", the equivalent size of "NPS" shall be taken from the table given in Annex B.

The valve shall be subjected to the load test (close **7.8.1.3**) and leak tightness test (close **7.8.2.1**), after the endurance test.

7.7 Test methods and procedures

7.7.1 *Testing of materials and construction*

7.7.1.1 Testing for suitability of non-metallic materials on water quality

7.7.1.1.1 Test for growth of aquatic microorganisms in contact with non-metallic materials

The test shall be carried out in accordance with Appendix **D** of this standard.

This test assesses the ability of a product to promote a significant degree of growth of aerobic microorganisms when in contact with water and takes 7 to 9 weeks to complete.

The mean dissolved oxygen difference (MDOD) value obtained for a product is a measure of the ability of the product to support the growth of aquatic microorganisms – as the growth of the microorganisms increases oxygen is removed from the test system and this loss is compared with the control system. Therefore, the greater the loss of dissolved oxygen from the water in contact with the product, so the greater the final value. MDOD is the mean value from measurements taken at weeks 5, 6 and 7.

The MDOD between the water in contact with the product and the negative control system must be less than 1.7 mg L^{-1}.

If after seven weeks the MDOD value is between 1.7 and 2.0 mg L^{-1}, then the test can be continued for a further two weeks. If the final MDOD value, over week five to nine, is less than 1.7 mg L^{-1}, then the product complies.

If the product gives an MDOD value in the range 1.7 to 2.9 mg L^{-1}, then two further samples of the product can be tested. The arithmetic mean of the MDOD values from the three samples must be less than 2.4 mg L^{-1} for the product to comply with the specification.

If the product gives an MDOD value greater than 2.9 mg L^{-1} then the product does not comply with the specification and no further testing is acceptable.

NOTE: An additional reference system is included for cementitious products or those containing bacteriostatic or bactericidal compounds. If the reference system shows a reduction in MDOD greater than 0.6 mg L^{-1} of the MDOD obtained for the positive reference system (paraffin wax), the product is reported as showing a bacteriostatic or bactericidal effect.

Testing period may be 7 to 9 weeks.

7.7.1.1.2 Test of toxicity due to leachate of the constitute or impurities into water

The test shall be carried out in accordance with Appendix **D** of this standard.

This test assesses the leaching of metals from the product into water.

Any metal detected in the aqueous extracts from the product must be at a concentration less than the Maximum Admissible Concentration (MAC) as given in Table **4** under clause **6.1.3.2**. The test is carried out on duplicate test samples and both test samples must comply with the specification.

If the MAC of any metal is exceeded in either of the duplicate final extracts from the test product then the product does not comply to meet this specification, unless three further duplicate test samples are tested and the concentrations of the specified metals in the extracts from all of three additional samples do not exceed the MAC.

Testing period may be 21 days.

7.7.1.1.3 Test for chemical composition of stainless steel

Chemical composition tests are required to verify that the stainless steel material used for manufacture of globe valve is in complying with the standard specified under the clause **6.1.2** of this standard.

As examples, the test can be carried out by either Spark Optical Emissions Spectrometry (OES), Spark atomic emission spectrometry, Positive Material Identification (PMI) or X-Ray Fluorescence (XRF) complying with the standards **ISO 6306**.

7.7.1.1.4 Test for corrosion resistance of stainless steel

Corrosion tests are required to verify that the stainless steel material remains without exceeding limits of different types of corrosion specified in Table **12**.

Table 12- Test methods and acceptance criteria for different types of corrosions

Type of corrosion	**Applicable Test**	**Assessment criterion**	**Acceptance criterion**
Intergranular	ASTM 262-15 – Test method B	Mass lost per unit area	0.1 mm/month (4 mils/month)
Pitting and Crevice	ISO 15158	Determination of CPT	Agreement between manufacturer and the purchaser

The pitting and crevice corrosion is evaluated to find out the temperature at which the material produces pitting and crevice. This temperature is defined as Critical Pitting Temperature (CPT) of the stainless steel material on pitting and crevice Corrosion. Critical Pitting Temperature (CPT) is the technique used to determine the temperature at which the material produces pitting. In CPT, specimens are exposed for 72-hour periods to increase temperatures incrementally. The temperature is increased until pitting is observed, which is recorded as the Critical Pitting Temperature (CPT).

The CPT for pitting and crevice shall be tested in separate tests as specified in ISO 15158 using standard test solutions complying with ISO 9227 relevant to testing of pitting and crevice corrosion.

7.7.1.1.5 Test for Chemical composition of copper alloys

Chemical composition tests are required to verify that the copper alloy material used for manufacture of globe valve is in complying with the standard specified under the clause **6.1.1** in this standard.

Chemical composition test shall be conducted using standard test specified in the standard **SLS EN 15079**.

As examples, the test can be carried out by either Spark Optical Emissions Spectrometry (OES), Spark atomic emission spectrometry, Positive Material Identification (PMI) or X-Ray Fluorescence (XRF) complying with the standards **SLS EN 15079**.

7.7.1.1.6 Test for dezincification resistance of copper alloys

Resistance to dezincification tests is required to verify that the stainless steel material remains without exceeding limits of plug type and layer type corrosion due to dezincification as specified in Table **13** below.

Table 13- Dezincification of copper alloys

Type of corrosion	Applicable Test	Assessment criterion	Acceptance criterion
(1)	**(2)**	**(3)**	**(4)**
Dezincification; plug type or layer type	ISO 6509-1 and ISO 6509-2	Determination of depth or width of corrosion along any direction	Less than 200 µm

7.8 Testing of performance

In case of pressure rating of the valve is in pressure class number or Psi the test pressure shall be fixed as given in Appendix **B**.

Note 1
All tests specified under this section shall be conducted on the same globe valve.

7.8.1 Mechanical strength

7.8.1.1 Test of resistance to internal pressure of the shell and all internal components

Test Method:
Test media shall be water and test can be conducted at ambient temperature. The valve is installed on a water supply pipe line to be able to develop the static pressure equal to 1.5 times PFA at inlet of the valve. The supply line is connected to inlet of the test valve via a throttling valve and the other end of the pipe connected to outlet port of the test valve is also accommodated a throttling valve. During the test the test valve is kept fully open and pressure at the inlet of the test valve is kept to required test pressure by closing the downstream valve or partially throttling it if necessary. Then the test valve with this set up is kept for the time period of 10_{0}^{+1} min.

Typical arrangement for test apparatus is shown in Figure **5** below.

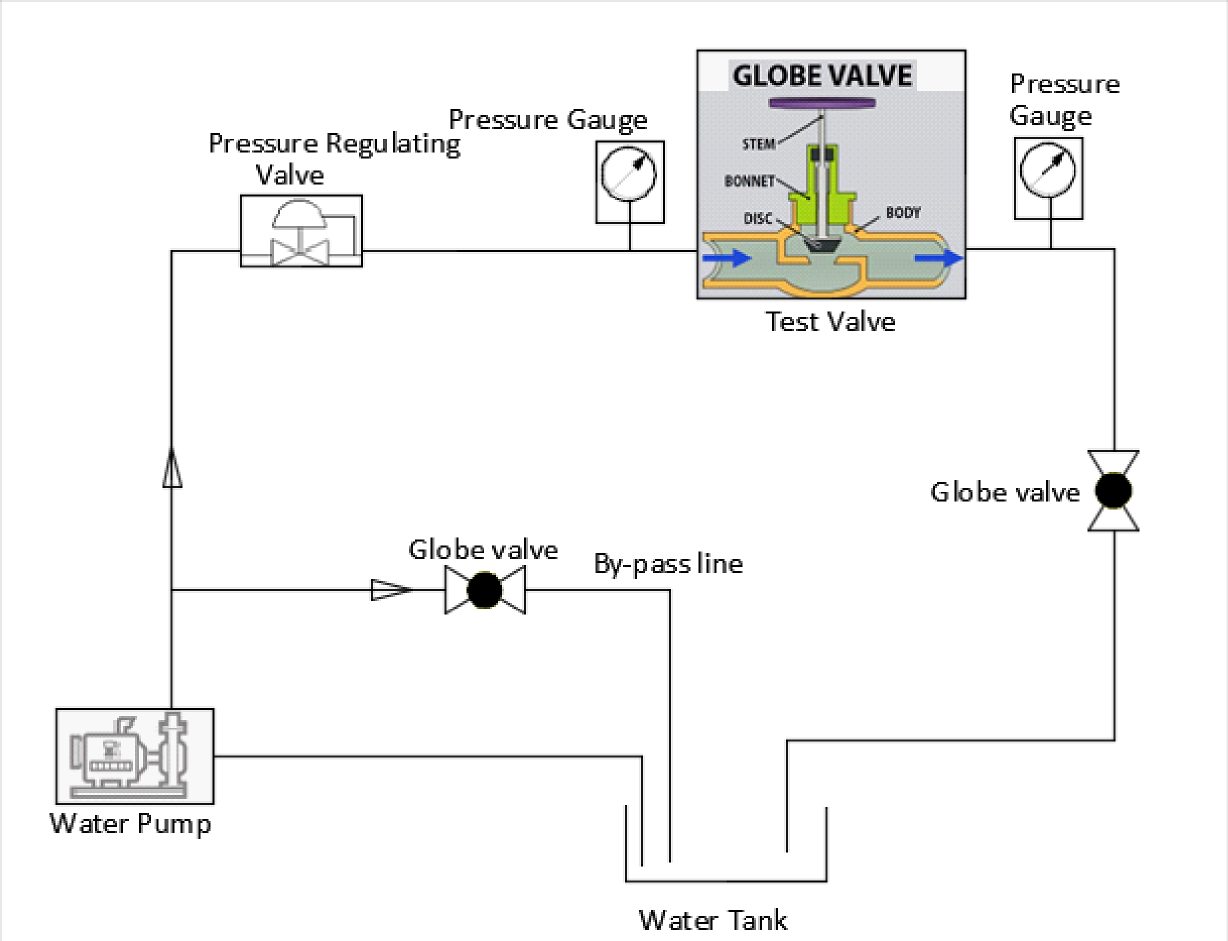


Fig. 05 : Test Apparatus of Test of resistance to internal pressure

Acceptance criteria:
During the test there shall not be any type mechanical defect or leakage on the body or components detected by visually.

7.8.1.2 Test of resistance of the obturator to differential pressure

Test Method:

Test media shall be water and test can be conducted at ambient temperature. The valve is installed on a water supply pipe line to be able to develop the static pressure equal to 1.5 times PFA at inlet of the valve. The supply line is connected to inlet of the test valve and the other end of the valve kept open without connecting to a pipe. Upstream pipe may have bypass line with a throttling valve. A throttling valve too may be required in between bypass line and the test valve. During the test, the test valve is kept closed fully with maintaining upstream pressure is equal to the lower of two values among (1.5 x PFA) and (PFA + 5 Bar). Then the test valve with this set up is kept for the time period of 10_{0}^{+1} min.

Typical arrangement for test apparatus is shown in Figure **6** below.

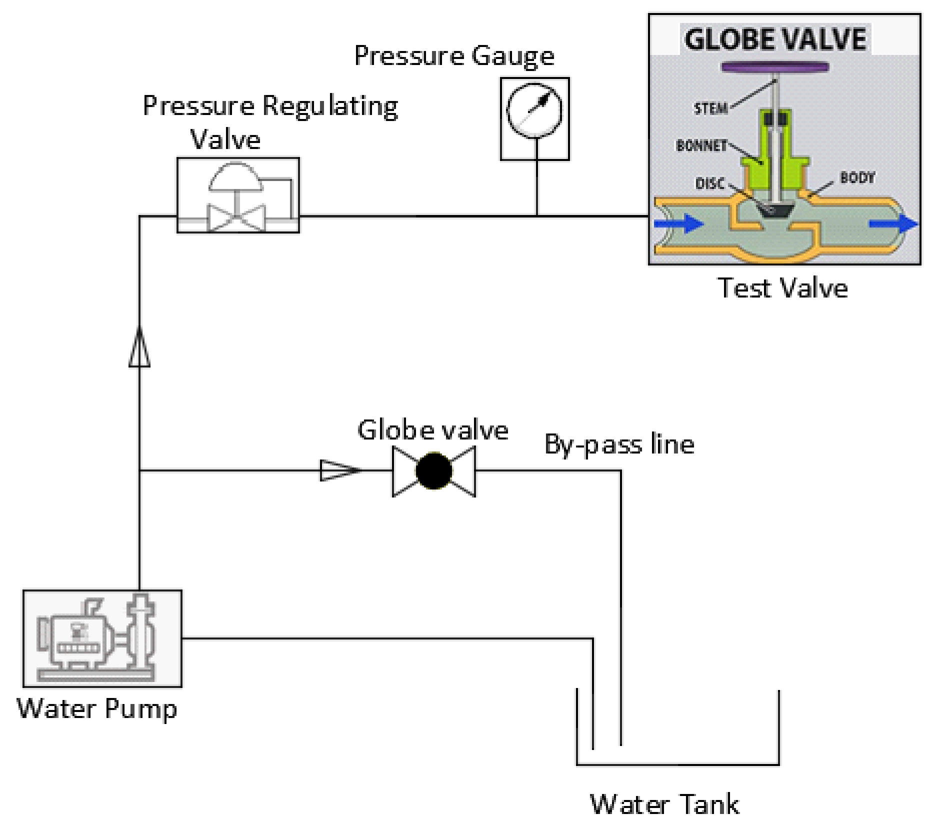


Fig. 06 : Test Apparatus of Test of resistance to internal pressure

Acceptance criteria:

During the test there shall not be any type mechanical defect or leakage on the body or components detected by visually.

7.8.1.3 Testing of resistance of valve to operating load (Torque Test)

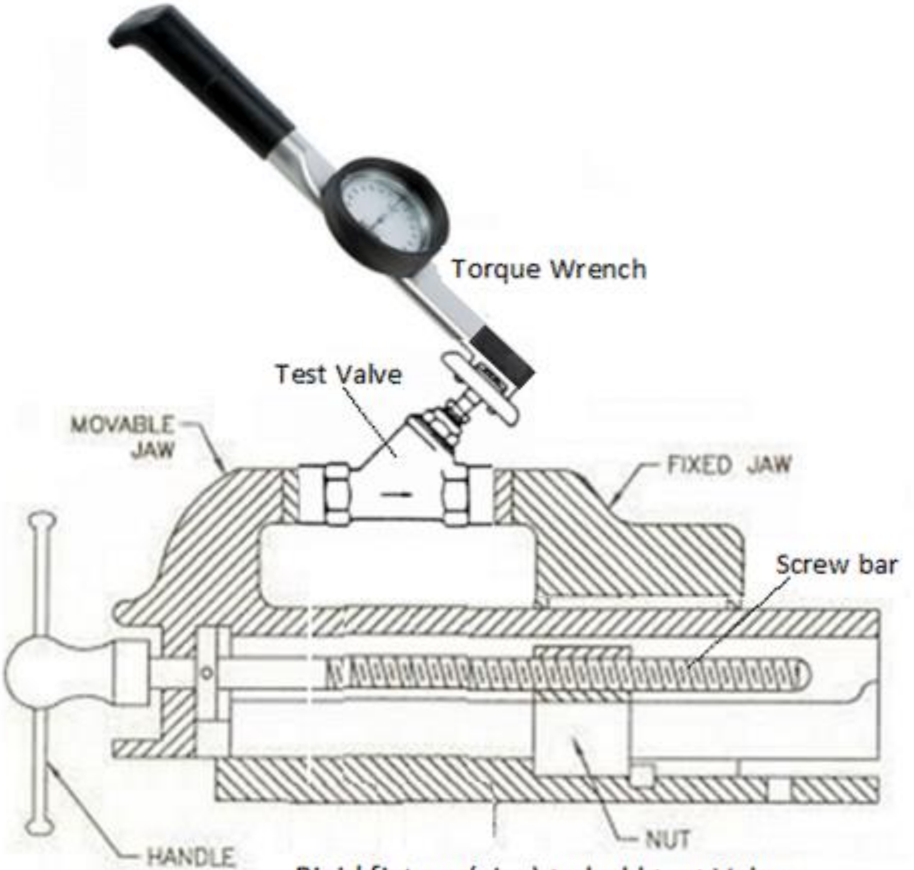
This test verifies the ability of the globe valve to resist under an applied torque.

NOTE: Tests specified under clauses **7.8.1.3** – torque test and **7.8.1.5** – bending test shall be carried out in the sequence of this standard for the same valve.

Test method and procedure:

The testing shall be carried out against the load (torque) applied on the test valve is given by the Table **10** under clause **7.4.3**.

If the sealing mechanism with elastomer washer, it is replaced by metal washer of same dimensions. The assembled valve with metal washer is mounted on a rigid body as shown in the Figure **7** as shown below.



Rigid fixture (vice) to hold test Valve

Fig. 07: Apparatus for testing of operating load

The assembled unit should be rigid enough to hold the test valve stationary while it is undergoing to test. The operating device is facilitated to rotate by a torque wrench to be able to read operational torque in Nm.

The operating device shall be rotated at uniform speed of 5±1 cycles per minute. Rotation can be manual. At the end of each extreme position (i.e. while the operation in opening mode; stop position and while the operation in closing mode; open position) the test torque is gradually increased until reach the corresponding value given in the Table **10** under clause **7.4.3**. This torque shall be lasted for the period of $30_{0}^{+3}\ s$.

Acceptance criteria:

There shall withstand the applied torque without any mechanical defects such as rupture, fracture, cracking or deformation observed visually and shall not impair the functions and leak tightness of the valve.

7.8.1.4 Testing of resistance to torsional moment on the valve body with threaded end connections

Test method and procedure

Test media shall be water and test can be conducted at ambient temperature. The test valve shall be fixed on the two pipe pieces of carbon steel having wall thickness not less than 3 mm or other type of steel pipe which is more strength than carbon steel pipe as shown in the Figure **8**. The pipe pieces shall be tightened on the valve by preparing its connecting end thread in compliance with ISO 7-1, corresponding to the thread of the end connection of the test valve. If the test valve is with male thread, the threaded end of the pipe pieces shall be the thread type ISO 7-1 R_C. If the test valve is angle pattern, the valve can be fixed on the same mounting arrangement to have 90^0 between the two axes of pipes on fixture and the pipe for accommodating test load. Torque applied for fixing the valve to the pipes should be less than the values specified in Table **14**. The valve is supplied with the nominal pressure with the ball in closed position. Once the valve is ready for testing the specified torque as given in the Table **10** in clause **7.4.3** is applied on the point indicated (MT_1) in the figure for a period of 10s. Subsequently, the test valve shall be tested for both the seat tightness tests specified under the clause **7.7.2.**

Acceptance criteria:

During the test, the valve body and its components shall withstand the applied pressure without any mechanical defects such as rupture, cracks or other visible failure or visual leakage.

After the test, the valve shall be able to be operated by applying the operating torque specified in Table **11** under the clause **7.4.4**.

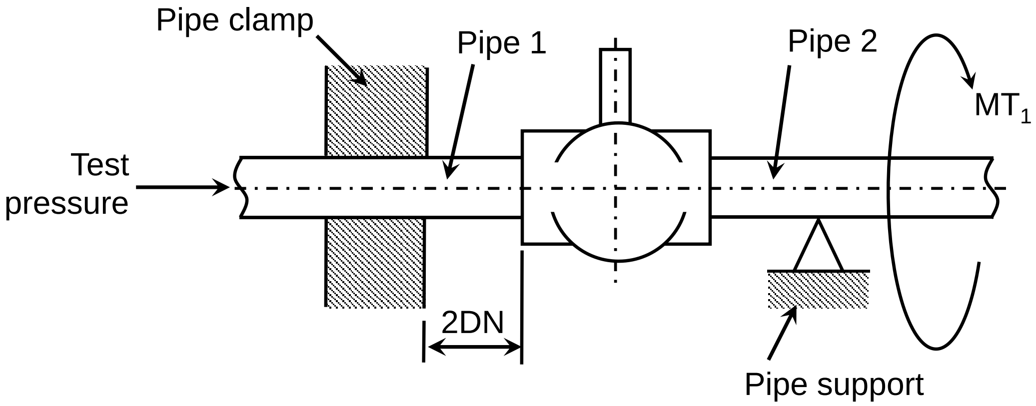


Figure **8** – Test apparatus for testing of resistance to torsional moment on the valve body

7.8.1.5 Testing of resistance to bending forces on the valve body with threaded end connection

Note:

This test shall be followed by the torque test with the same test valve.

Test Method and procedure:

Install the test valve in a test rig as shown in Figure **3**, shown under clause **7.4.4**, attached to the inlet a steel pipe complying with EN 10255 (medium series) having a length more than 1000 mm and same diameter as the nominal size of the test valve.

Apply a force F, as given in Table **11** to the point located having distance of $1000_{0}^{+10} mm$, from the end face of the valve inlet port in order to produce bending moment on the valve and maintain it for the duration of $30_{0}^{+3}\ s$.

7.8.1.6 Resistance to bending forces on the valve body of DN 50 – only for the flanged type

Test media shall be water and test can be conducted at ambient temperature.

Test apparatus:
The test valve is fixed rigidly in between two pipe pieces placed in each side of the test valve. The pipe pieces are accommodated facilities of filling water with air venting and pressurizing the filled water. In this arrangement water supply and pressurizing facilities are placed in upstream side while water leakage collection facilities are placing in downstream side. The assembled unit is mounted on simple support system as shown in the Figure **9** below which is ready for testing.

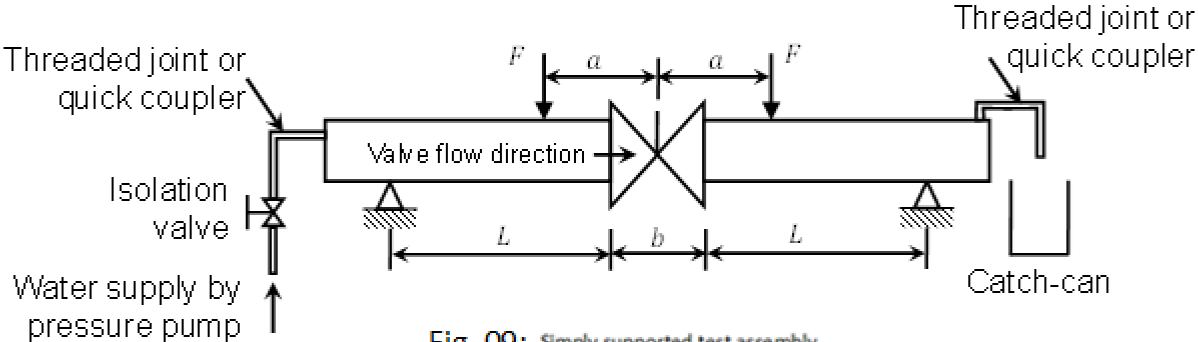


Fig. 09: Simply supported test assembly

In this diagram point of intersection of two diagonals of the valve symbol represents the center of the test valve and end connecting lines of the symbol represent the connecting end face of the test valve. In the test unit overhang outside distance of two pipe ends shall not exceed the value of 0.001 X DN number in meter. In this case it shall be 0.05 m.

Test procedure:

Test unit is completely filled with water (Test media) without cavities or air pockets inside and close the valve completly. Then two forces denoted by F in the diagram is applied in a same plane symmetrically in each side of the test valve by keeping same distance, denoted by “a” in the diagram. The value of the “F” is calculated by using following equation substituting the value for “M” equal to 1050 Nm.

$$F = \frac{1}{2L+b-2a}\left[2M - PL\frac{L+b}{2L+b}\right]$$

Demarcation of “L”, “a” and “b” are illustrated in the Figure

“L” shall be minimum of (0.005 x DN-value in to meters)

L = 0.005 X 50 = 0.25 m

“b” is face-to-face distance of ends of the test valve in meters.

“a” can be a comfortable value and shall be greater than b/2 in meter.

“P”s the force in Newton, generated by total mass of test unit including water filled in the test unit.

With application of test forces the unit is pressurized up to PFA recommended for the test valve and maintain for the period of 10_{0}^{+1} min.

7.8.2 *Test of leak tightness of the shell and all internal components*

7.8.2.1 Leak tightness to internal pressure (Hydrostatic Pressure Test)

Test method:

Test media shall be water and test can be conducted at ambient temperature. The valve is installed on a water supply pipe line to be able to develop the static pressure equal to 1.5 times PFA at inlet of the valve. The supply line is connected to inlet of the test valve via an isolating valve and the other end of the pipe connected to outlet port of the test valve is also accommodated an isolating valve. Initially the test unit is filled completely by water without any air trapped inside and then closed the downstream isolating valve drip-tightly. Then pressure of the test rig is increased up to test pressure by the pressure pump. The system pressure can be kept at constant level with help of a pressure accumulator. Typical test apparatus arranging hydrostatic pressure pump and pressure accumulator in the test apparatus is illustrated in the Figure **9** shown below.

During the test the test valve is kept fully open and pressure at the inlet of the test valve is kept to required test pressure by closing the downstream valve. Then the test valve with this set up is kept for the time period of 10_{0}^{+1} min.

Acceptance criteria:

During the test there shall not be observed visually any mechanical defects such as cracking, deformation etc. and any leakage on the body.

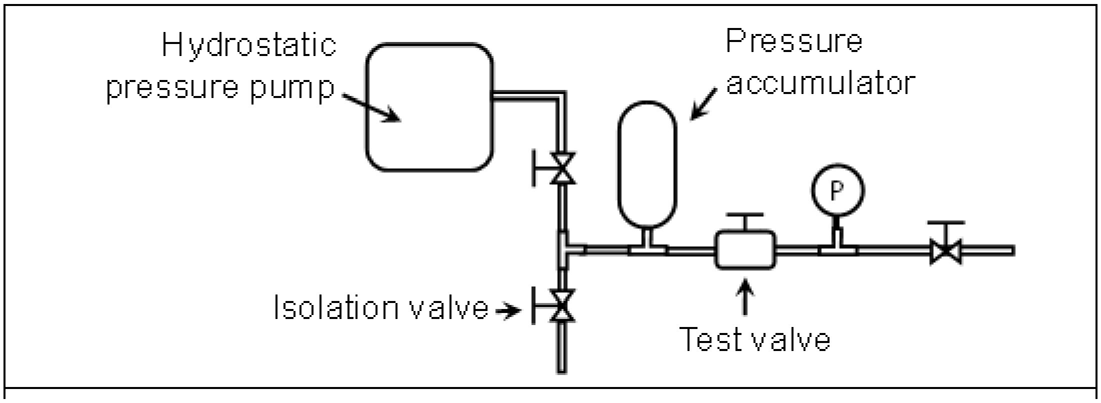


Figure 10- Hydrostatic Pressure Test Apparatus

7.8.2.2 **Leak tightn**ess to external pressure

Test method:

Test media ca be water to air and test can be conducted at ambient temperature. The valve is subjected to vacuum not less than 0.8 bar. Typical test apparatus is shown in Figure **11** below. In this apparatus, the test valve is immersed in water while sucking trapped air in the test valve and the vacuum creating pipe line. Once vacuum is reached at 0.8 bar isolate the leakage collecting tank and leave it for the time period of 10_{0}^{+1} min.

At the end of test open the drain valve of leakage collecting tank and measure the leakage collection by catch pot and measuring cylinder.

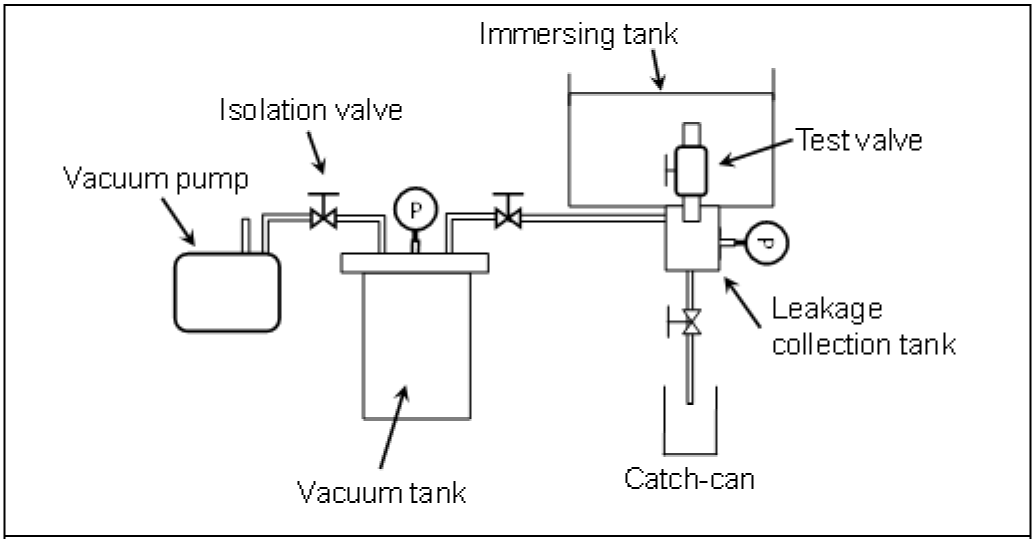


Figure 11- Vacuum test apparatus

Acceptance criteria:

There shall not be a single drop of water in to catch pot and measuring cylinder.

7.9 Testing of flow-capacity rating of valve

Test shall be conducted according to procedure given by the standard SLS EN 1267. Hydraulic circuit of typical test apparatus and test procedure is given in Appendix **E**.

7.10 Endurance Test

Endurance test verifies mechanical durability of operating mechanism, by subjecting to the headwork to a number of operating and closing operations.

This test is performed to find out the effects of repetitive cyclic valve operation at specific speed, on valve tightness, operating torque, and to monitor the wear behavior and malfunction of the parts.

The valve shall be remained without impair its intended performance after completion of operating cycles as specified in the standard, while delivering the flow through the supply and discharge pipes.

For the purpose of determination of conformity of the valve which is designated its nominal size in “DN” or “A”, the equivalent size of “NPS” shall be taken from the table given in Appendix **B**.

Test method and procedure is as detailed in Appendix **F**. Typical test apparatus is also shown in Appendix **F**.

8 MARKING

The body of the valve shall be marked legibly and indelibly the following by casting, stamping and engraving.

i. Nominal size;
ii. Pressure rating;
iii. Arrow indicating normal direction of flow, if it is necessary; and
iv. Make or Brand;

The following shall be marked either on the valve body or on an attached label, tag or packaging.

i. The manufacturers name or trade mark;
ii. Country of Manufacture;
iii. Thread size if the connection is threaded end;
iv. Flow coefficient of the valve;

v. If the material is dezincification resistance valve shall be marked symbol of "DZR" or "CR";

vi. Recommended operating temperature;

vii. De-rating factor (If applicable); and

viii. Designation as per clause **4**.

APPENDIX A
(Normative)

CRITERIA FOR CONFORMITY

COMPLIANCE OF A LOT

The sampling scheme given in Appendix A should be applied where compliance of a lot to the requirements of this Specification is to be assessed based on statistical sampling and inspection.

Where compliance with this Specification is to be assured, appropriate schemes of sampling and inspection shall be adopted based on manufacturer's control systems coupled with type tests and testing procedures.

A.1 LOT

A.1.1 In any consignment, all copper alloys or stainless-steel globe valves of the same nominal size and pressure rating belonging the one batch of manufacture shall constitute a lot.

A.2 SCALE OF SAMPLING

A.2.1 The samples shall be inspected and tested from each lot to ascertain the conformity of the lot to the requirements of this Specification.

A.2.2 The number of globe valves to be selected from a lot shall be in accordance with Table **A-1**.

Table A-1 – Scale of sampling

No. of globe valves in the lot (1)	**No. of globe valves to be selected** (2)
Up to 150	3
151 to 1 200	5
1 201 and above	8

A.2.3 One globe valve shall be selected at random from a lot for the material and construction test requirements.

A.2.4 One globe valve shall be selected at random from a lot for the microbiological test requirements. If respective tests are failed, additional units need to be drawn as specified in respective tests in Clause **6.1.3**.

A.2.5 Two globe valves shall be selected at random from a lot for the maximum flow velocity test requirement.

A.2.6 Two globe valves shall be selected at random from a lot for the testing of mechanical characteristics.

A.2.7 Two globe valves shall be selected at random from a lot for the endurance test.

A.2.8 All units shall be selected at random. In order to ensure randomness of selection, random number tables as given in **SLS 428** shall be used.

A.3 NUMBER OF TESTS

A.3.1 Each globe valve selected as in **A.2.2** shall be inspected for marking requirements specified in Clause **8**.

A.3.2 Globe valve selected as in **A.2.3** shall be tested for material and construction requirements specified in Clause **6.1.4.1**, **6.1.4.2**, **6.1.4.3** and **6.1.4.5** (components with applicable materials only).

A.3.3 Globe valves selected as in **A.2.4** shall be tested for material and construction requirements specified in Clause **6.1.4.4**, **6.1.4.5** (components with applicable materials only) and **6.1.4.6**.

A.3.4 Each globe valve selected as in **A.2.2** shall be inspected for construction requirements of end connections, flow passage, operating devices and sealing mechanism specified in Clause **6.2**, **6.3**, **6.4** and **6.5**.

A.3.5 Each globe valve selected as in **A.2.2** shall be inspected for performance requirements of opening and closing and operating pressure specified in Clause **7.1** and **7.2**.

A.3.6 Globe valves selected as in **A.2.5** shall be tested for maximum flow velocity requirement specified in Clause **7.3**.

A.3.7 Each globe valve selected as in **A.2.6** shall be tested for mechanical characteristics specified in Clause **7.4**.

A.3.8 Each globe valve selected as in **A.2.2** shall be tested for performance requirements of leak-tightness specified in Clause **7.5**.

A.3.9 Globe valves selected as in **A.2.7** shall be tested for endurance of the valve specified in Clause **7.6**.

A.4 TEST SEQUENCE

Tests and inspections to determine compliance with the requirement specified in Clause **6**, **7** and **8** shall be carried out on selected units of globe valves in the following sequence,

1) Clause **8** – Marking requirements
2) Clause **6** – Material and construction requirements
3) Clause **7.1**, **7.2**, and **7.5** – Performance requirements (non-destructive testing)
4) Clause **7.4** – Mechanical characteristics requirements (destructive testing)
5) Clause **7.3** and **7.6** – Other performance requirements (destructive testing)

If any test parameter which is specified in the above test sequence is not satisfactory, remaining test parameters shall not be carried out in respect of the compliance of sample to the standard.

A.5 CRITERIA FOR CONFORMITY

A lot shall be declared as conforming to the requirements of this Specification if the following conditions are satisfied.

A.5.1 Each globe valve inspected as in **A.3.1** shall satisfies the relevant requirements.

A.5.2 Globe valve tested as in **A.3.2** shall satisfies the relevant requirements.

A.5.3 Globe valve/s tested as in **A.3.3** shall satisfies the relevant requirements.

A.5.4 Each globe valve inspected as in **A.3.4** and **A.3.5** shall satisfies the relevant requirements.

A.5.5 Globe valves tested as in **A.3.6** shall satisfy the relevant requirements.

A.5.6 Each globe valve tested as in **A.3.7** shall satisfies the relevant requirements. All mechanical characteristics shall be complied to the specified requirements.

A.5.7 Each globe valve tested as in **A.3.8** shall satisfies the relevant requirements.

A.5.8 Globe valves tested as in **A.3.9** shall satisfy the relevant requirements.

APPENDIX B
(Normative)

EQUIVALENT NOMINAL SIZES AND PRESSURE RATINGS

For the purpose of determination of conformity of the valve which is designated its nominal size in “NPS” or “A”, the equivalent size of DN shall be taken from the table given below.

Table B-1 - Equivalent DN numbers for ball valves designated in “NPS” or “A”

NPS (1)	**A (2)**	**DN (3)**
¼	8	8
⅜	10	10
½	15	15
¾	20	20
1	25	25
1¼	32	32
1½	40	40
2	50	50

The equivalent of PN rating for “pressure classes” for globe valves covered in this standard are given in Table B-2 below.

Table B-2 - Equivalent PN rating for ball valves designated in “pressure class”

Pressure Class (1)	**PN (2)**
150	20
300	50
400	63
600	100

Table B-3 - Conversion of pressure ratings specified in Psi to approximate PN rating

Pressure in Psi (1)	**Conversion Factor (2)**	**Calculated value (bar) (3)**	**Approximated PN rating (4)**
100	14.5	6.90	6
150	14.5	10.34	10
250	14.5	17.24	20
300	14.5	20.69	20

APPENDIX C

(Informative)

DESCRIPTION OF GLOBE VALVE

A Globe valves is a linear motion valve and are primarily designed to stop, start and regulate the flow. It is comprised of a movable disc (obturator) integrated with a stem and a stationary ring seat in a confined body.

C.1 DISC – STEM CONFIGURATION

The stem of a globe valve may be designed to move up and down resulting in raising or lowering the disc while stem is being rotated or, be prevented from moving up and down while carrying out this task. The disc can be an integral part of stem causing the disc to rotate with the stem or disc can be designed to swivel freely on the stem. According to this mechanic of construction following disc – stem configurations are possible;

- Rising stem with rigidly fixed disc on the stem;
- Non-rising stem with raising and lowering the disc along the threaded stem;
- Rising stem with a jumper disc;

The disc can be integral sealing surface or incorporated with other sealing material.

C.2 BODY CONFIGURATION

This standard covers four patterns of flow way paths made different configurations of holes in a ball (sphere) which is placed in a body having two or three ports in order to produce different flow patterns

The body is built in through circular holes to have different flow patterns
Body can be designed in three different shapes in order to accommodate inlet port, valve passage and outlet port.

C.3 Z-SHAPED BODY (STRAIGHT PATTERN)

Inlet port and outlet port are placed inline and valve opening passage (cross section of the flow) is parallel to the axis of ports. So that fluid enters in axial direction of the inlet port and turn by 90^0 to pass through the valve opening passage and then again turn 90^0 opposite direction resulting in flow through the outlet port parallel to inflow. This path of the flow is taken similar to “Z” shape. The typical configuration of this type of valve body is shown in the Figure 1: below.

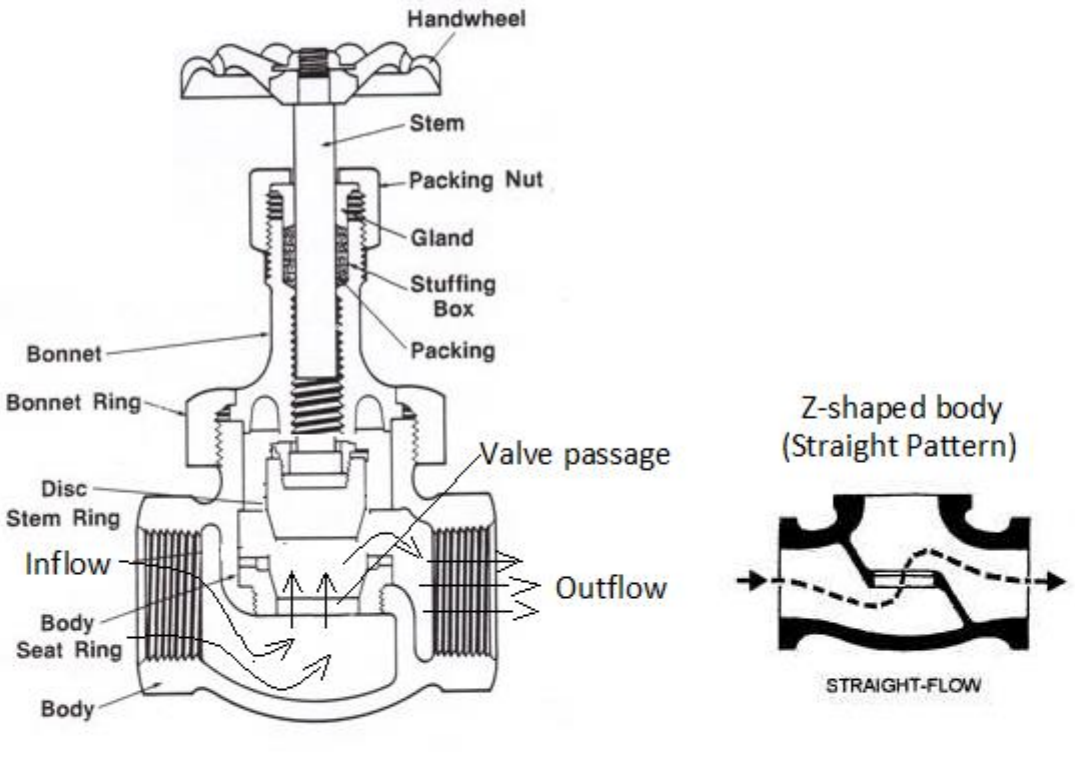


Fig. 01: Straight Pattern Globe valves

Angle valve body pattern (Angle Pattern):

Angle valve body is designed so that the inlet and outlet are perpendicular to each other. By considering characteristic of fluid flow through an orifice, this type of body is designed to make the flow through inlet port and the valve passage in same direction and then the flow turn 90^0 to be able to discharge through the outlet port. The typical configuration of this type of valve body is shown in the Fig. 02: below.

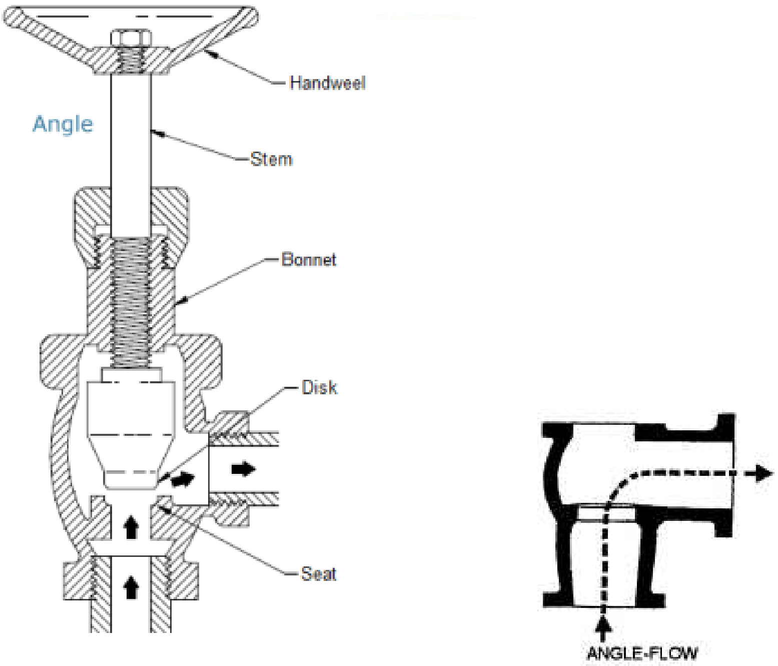


Fig. 02: **Angle Pattern Globe Valve Body**

Oblong valve body ("Y" Pattern):

The Y-body, configuration, the stem enters the valve body at 45°, while inlet and outlet remain in line, as with the "Z" type pattern. The configuration of this type of valve body is shown in the Fig. 03: below.

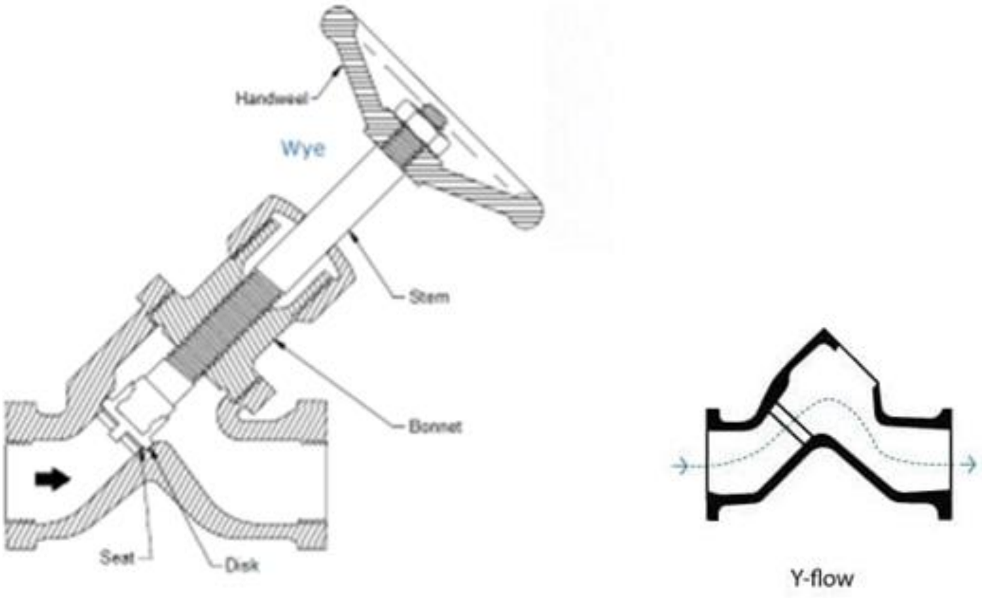


Fig. 03: **Oblique Pattern or Y Pattern Globe Valve Body**

Cross-flow valve body pattern:

Cross-flow valve body is designed to have three ports perpendicular to each other. The valves designed for flow mixing purpose the ports are connected to have two inlet ports and the valves designed for flow dividing the ports are connected to have one inlet port with two outlet ports. The configuration of this type of valve body is shown in the Fig. 04: below.

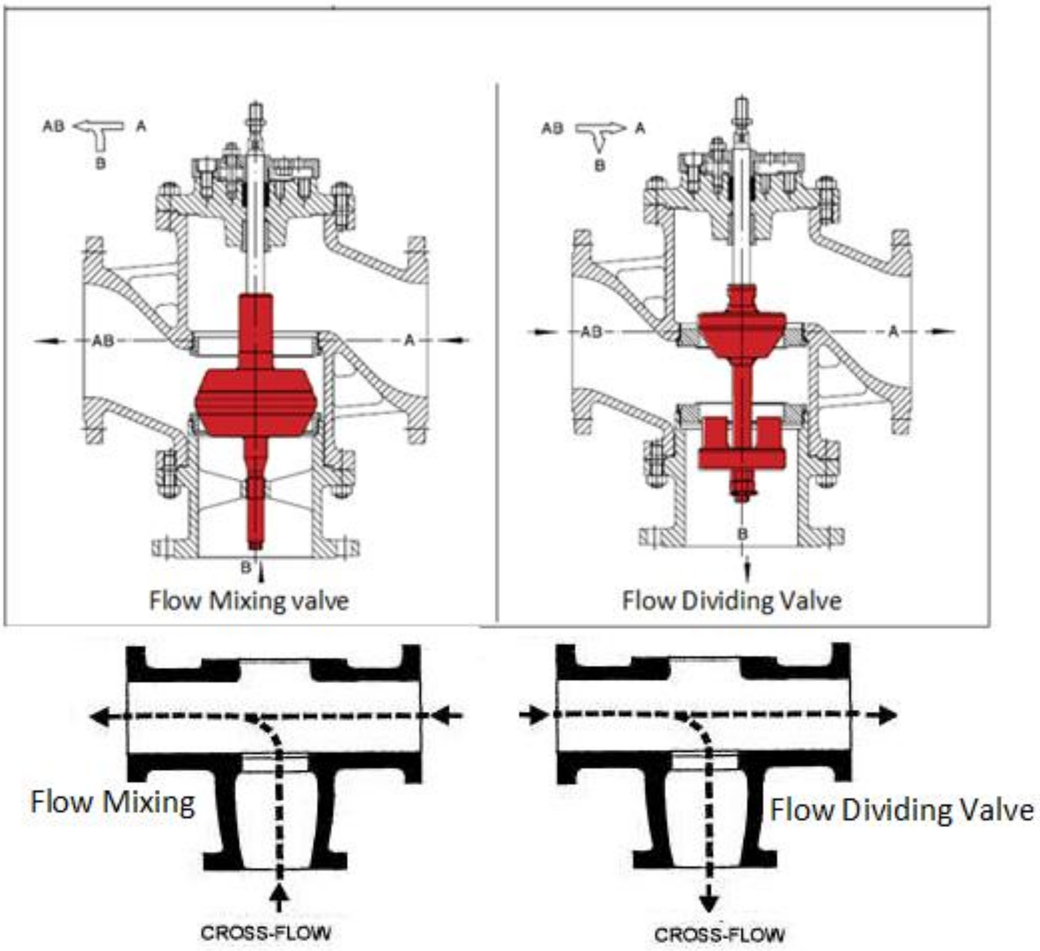


Fig. 04: Cross-flow valve body pattern

Appendix D

(Normative)

Suitability of non-metallic materials on water quality

1. Requirement of non-metallic parts on maintaining water quality in contact with water:

The constitutes or impurities of the non-metallic materials used in construction of the valve shall not make any effect on deteriorating wholesomeness of the water intended for human consumption in concern with

- growth of aquatic microorganisms
- toxicity

due to leachate of the constitute of impurities into water. These quality parameters are the results of dissolving or suspending particles in potable water.

2. Specifications and acceptance criteria:
2.1. Growth of aquatic microorganisms:
(Source: BS 6920-1)

NOTE:
The criteria used to assess the ability of a product to support an appreciable growth of aquatic microorganisms have been specified from a review of data and information given in BS 6920-1:2000 and BS 6920-2.4:2014)
When samples drawn from more than one commercial batch of a product are compared for the purpose of quality assurance or formulation development, some variation in the results should be anticipated. Any variation in results should be critically examined in light of the precision of the method and also the homogeneity of the material or the conditions employed during manufacture or storage, as these can substantially alter the characteristics of some products with respect to the availability of chemical substances that act as nutrients for microbial growth.
The criteria given in specified under this clause have been set in the light of the precision of the method, which was calculated on the basis of a homogeneous reference material.

When a product is examined by the method given in Clause 4.1, it shall be deemed not to support appreciable microbial growth if the mean dissolved oxygen difference (MDOD) is 2.39 mg/l or less.
If a single sample of a product gives an MDOD value that is greater than 1.69 mg/l but not more than 2.9 mg/l, then two further samples of the product shall be examined. If the arithmetic mean of the three MDOD values obtained is 2.39 mg/l or less, then the product shall again be regarded as not being capable of supporting an appreciable microbial growth when in contact with water intended for human consumption.

NOTE:
The significance of any bacteriostatic/bacteriocidal effects observed, and/or any changes in the appearance of the tested samples, may be assessed by the National Regulator

2.2. The extraction of metals

(*source BS 6920-1; Note: see also paragraph seven of the Introduction*)

NOTE 1:

The extraction of the metal described under this clause deals with the extraction of certain metals, undesirable in excessive amounts, from non-metallic products. The limits for these metals are given in Table 01. The range of metals included in this specification reflects the current data and information recognized and published by WHO and international standards of United Kingdom and other Europe countries which are likely to arise in waters intended for human consumption, as a result of contact with the materials of construction of water storage and distribution systems. Products included in this standard for testing in the future may need to amend in order to include contain other metals which may be undesirable in excessive amounts but which are not listed in Table 01 . In this case, it will be necessary to obtain an expert opinion from a competent national authority on the desirability of including their determinations in this test.

When tested in accordance with clause 4.2 in this standard, the product shall be deemed suitable for contact with water intended for human consumption if the amounts of the specified metals in the final extracts do not exceed the specified limits given in Table 01.

If the limit for any metal is exceeded in either of the final extracts, then the product shall be deemed unsuitable for contact with water intended for human consumption unless a further three untested samples are tested and the amounts of the specified metals in all of the further final extracts do not exceed the limits specified in Table **01**.

Table 01 — Maximum allowable concentrations of metals specified in the standard

Metal	**Maximum allowable Concentrations µg/l**	**Reporting limits [a] µg/l**	**Expression of results**
Aluminium	200	20	Al µg/l
Antimony	10	0.5	Sb µg/l
Arsenic	50	1	As µg/l
Barium	1000	100	Ba µg/l
Cadmium	5	0.5	Cd µg/l
Chromium	50	5	Cr µg/l
Iron	200	20	Fe µg/l
Lead	50	1	Pb µg/l
Manganese	50	5	Mn µg/l
Mercury	1	0.1	Hg µg/l
Nickel	50	2	Ni µg/l

Selenium	10	1	Se µg/l
Silver	10	1	Ag µg/l
NOTE 1 The significance of results that conform to the specified limits in Table 1 in the seventh test extracts, but exceed the limits in the first extracts may be assessed by the National Regulator. **NOTE 2** The National Regulator may also specify analysis for other metals and assess the results obtained.			
...[a] - The reporting limits required by the National Regulator for some of the metals are based upon the new lower requirements specified in the EC Directive on the quality of water intended for human consumption (98/83/EC). In many cases the analytical detection limits for a particular method in a particular laboratory may well be better than the National Regulator's requirement for the reporting limits.			

When a metal fitting has been used in the testing of a product, the assessment shall be made on the differences in concentrations of the specified metals between the final extracts and the metal fitting blank test.

If the results from the first 24 h extracts conform to the limits in Table 1, then the first extracts shall be defined as the final extracts.

NOTE 2 Experience from testing products using the method described in BS 6920-2.6 over a number of years has shown that products that satisfy these criteria on the first 24 h extracts also conform to the final 24 h extracts.

3. Test sample:

(Source BS 6920-2.1)

3.1. Nature of samples

The sample used for testing shall be manufactured products or components of the product drawn from representative production batches that have received no other treatment.

3.2. Sample size and test container size

Use, wherever possible, a sample with a total area of (15,000 ± 500) mm^2 and a test container bearing calibration mark for a capacity 1,000 ml. If in exceptional circumstances this size of container cannot be matched with the test sample, use a test container calibrated for a capacity in accordance with Table 07 as appropriate. The sample shall be made up from one or more article drawn from a single larger product. The maximum length and width of any single sample shall be 150 mm and 70 mm respectively.

During testing, the samples shall always be completely submerged in the test water. If the density of the sample is less than that of water, the sample shall be kept totally submerged for the duration of the test by using glass encapsulated weights of which density is enough to hold the sample in water (see figure shown below).

Determine the dimensions of all samples using measuring equipment calibrated in accordance with ISO 10012. The instruments used shall include steel rules and calipers conforming to the accuracy requirements given in the Tables 02 and Table 03 (BS 4372:1968, 2.5.4 and BS 887:1982, clause 6) respectively.

For all rubber (elastomeric) materials record the maximum inradius for the test piece for inclusion in the test report.

(Source BS 4372, clause 2.5.4)

Table 02: Accuracy of Graduation of Steel rules:

Rule Length	**Departure from nominal**		
	Up to and including 300 mm	**Over 300 mm up to and including 500 mm**	**Over 500 mm up to and including 1 m**
	mm	**mm**	**mm**
Distance between any two graduation lines on a single scale	0.1	0.2	0.25
Distance between any two adjacent graduation lines	0.05	0.05	0.05
Position of 10 mm graduation line from its flat end datum	0.08	0.08	0.08

(Source BS 887, clause 6)

Accuracy of the reading of caliper:

The deviation of reading at any position within the measuring range of the caliper shall be not greater than as shown in Table 02 when tested in accordance with method specified in Annex B.

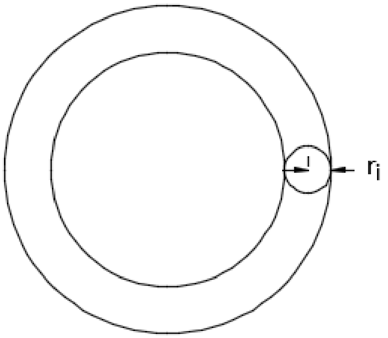
Table 03: Deviation of the reading of caliper

Metric		**Imperial**	
Measured Length	**Maximum deviation of reading**	**Measured Length**	**Maximum deviation of reading**
mm	**mm**	**in**	**in**
Between 0 and 300	± 0.02	Between 0 and 12	± 0.001
Over 300 up to and including 600	± 0.04	Over 12 up to and including 24	± 0.0015
Over 600	± 0.06	Over 24	± 0.002
Note: measured length refers to the portion of the length of the scale being measured and is not to be confused with the measuring range (size) of the caliper.			

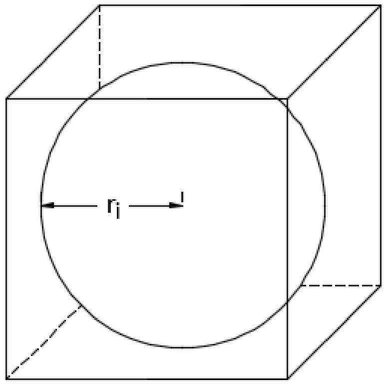
Definition of inradius:

The radius of largest sphere that will fit in the thickest section of a rubber based test material or product (see following figure).

Fig. … : the radius largest sphere that will fit in the thickest section of a rubber based test material or product

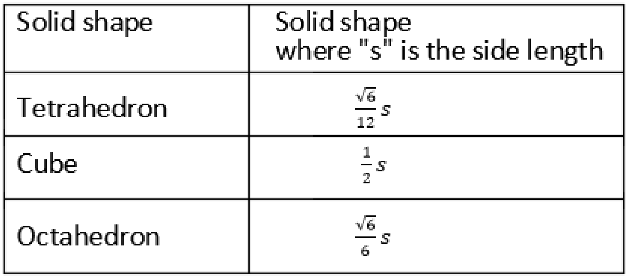


a) Inradius of an O-ring



a) Inradius of a cube

Note: The cross sectional thickness of the thickest section of a test sample = 2 x inradius



Solid shape	Solid shape where "s" is the side length
Tetrahedron	$\frac{\sqrt{6}}{12}s$
Cube	$\frac{1}{2}s$
Octahedron	$\frac{\sqrt{6}}{6}s$

If the sample has a textured finished to the surface, or the shape of the sample is such that accurate calculation of the surface area is impracticable, then a sample of estimated surface area shall be used. In this case the length and width shall be recorded together with a sufficiently detailed description of the product(s) to enable further samples to be prepared that will be within ±10% of the surface area of the original sample.

Note:

Supplier of the samples should be instructed to ensure that the products or test samples represent the product as it is used in contact with water intended for human consumption. If the product has to be cut to obtain the required sample area, this should be done before the samples receive any post-cure or special surface treatment and in a manner that ensures the area of the cut edges id as small as possible.

3.3. Sample storage

The sample shall be protected from contamination by dirt, oil, grease, excessive heat, sunlight and volatile chemicals. Store samples in the laboratory in polyethylene bags and in the absence of light at $(21\pm4)^0$C except where the individual supplying the samples provides alternative written storage instructions, which are those that the products are subjected in practice. Use a fresh bag for each product or set of products made from an identical material.

Do not test samples bearing adhesive tape or labels, ink or pencil marks. Polyethylene bags are not suitable for the storage of thermosetting rubber components.

Polyethylene bags suitable for sample storage:
Polyethylene bags should be food grade type. Prior to use, the bags shall be stored in a closed container. The bags shall not be used for thermosetting rubber compound.

Thermosetting products:
Thermosetting materials, including thermosetting elastomers, shall be tested in their final manufactured form.

Note 1:
Unlike thermoplastic materials, the performance of thermosetting materials, e.g. most rubber compounds, glass reinforced plastics, (GRP) and epoxy resin based products can vary in the test specified in this standard according to the conditions of final cure (together with any post cure treatments) and method of manufacture, e.g. compression moulding and extrusion.

Elastomeric products shall be stored in accordance with BS ISO 2230 except that storage envelopes or pockets shall not be sealed, dusting powder shall not be used and cleaning shall not be carried out unless any of these producers form part of the usual production procedures.
Suppliers of elastomeric products shall be instructed to arrange for storage of products for at least four weeks before dispatch to the laboratory.

Note 2:
If samples of elastomeric products are tested within four weeks of manufacture, the results obtained with these method might not be representative of the material as it is used in practice.

4. Testing of effect of non-metallic materials on water quality:

(Source BS 6920-2.4)

4.1. Test of GROWTH OF AQUATIC MICROORGANISMS

4.1.1. Test principle

Tap water in contact with a sample of the product is inoculated with a mixture of naturally occurring aquatic microorganisms. The overall growth/activity of the microbial population is determined indirectly by the measurement of dissolved oxygen depletion in the test system and a control. Validation of the results is achieved by the assessment of reference materials tested in parallel with the sample.

This test assesses the ability of a product to promote a significant degree of growth of aerobic microorganisms when in contact with water and takes 7 to 9 weeks to complete.
The mean dissolved oxygen difference (MDOD) value obtained for a product is a measure of the ability of the product to support the growth of aquatic microorganisms – as the growth of the microorganisms increases oxygen is removed from the test system and this loss is compare with

the control system. Therefore, the greater the loss of dissolved oxygen from the water in contact with the product, so the greater the final value. MDOD is the mean value from measurements taken at weeks 5, 6 and 7.

The MDOD between the water in contact with the product and the negative control system must be less than 1.7 mg/l

If after seven weeks the MDOD value is between 1.7 and 2.0 mg/l, then the test can be continued for a further two weeks. If the final MDOD value, over week five to nine, is less than 1.7 mg/l, then the product complies.

If the product gives an MDOD value in the range 1.7 to 2.9 mg/l, then two further samples of the product can be tested. The arithmetic mean of the MDOD values from the three samples must be less than 2.4 mg/l for the product to comply with the specification.

If the product gives an MDOD value greater than 2.9 mg/l then the product does not comply with the specification and no further testing is acceptable.

A flow diagram showing the sequence of the test procedure is given in Fig. A-1, Annex A.

4.1.2. Test premises

Carry out the test in premises as free as practicable from the presence of any volatile organic chemicals in atmosphere. As such chemicals can dissolve in exposed water surfaces in sufficient quantities to produce abundant microbial slimes which will mask similar growths due to the test samples.

Note: The volatile chemical most frequently responsible for such slimes is ethanol, but many other volatile chemicals used in or near the test premises can produce this effect. Even though the containers are sealed during incubation, their contents may become contaminated during water changes.

4.1.3. Safety

As well as statutory and general consideration of safety, particular care shell be taken in microbiological laboratories because the organisms present may be pathogenic. Media not being used specifically for test for pathogens may enable pathogens to grow until present in large numbers, so care shall be exercised in the handling and disposal of all media after incubation. Any written safety guidance shall be supplemented by thorough training and supervision.

Note:
The test presented in this section of this standard fall within the scope of the report entitled "Categorization of pathogens according to hazard and categorized of containment" published by Health and Safety Executive (1990). Generally, containment Level 2 facilities are required.

4.1.4. *Reagent*

4.1.4.1. General

Excerpt where otherwise specified, only reagents of analytical grade shall be used.

4.1.4.2. Inoculum water

Inoculum water consisting of a fresh sample taken from a lowland surface water suitable for abstracting for water intended for human consumption preparation and that confirms to Table 04.

Table 04: Quality criteria for inoculum water

Parameter	**units**	**Minimum value**	**Maximum value**
pH	-	5.5	9.0
Copper	mg/l	-	0.05
Total presumptive coliforms	per 100 ml	10	-
Presumptive pseudomonads	per 100 ml	1	-

Conformity of the inoculum water with the criteria in table 3 shall be determined on the basis of analysis of the sample of surface water. Analyses of the water shall be performed in accordance with the appropriate sections of BS 6068 or, if none exist, with "Methods for examination of Water and Associated Materials".

Inoculum water shall be used within 6 h of collection. If suspended solid are present the water shall be filtered (using filters of average pore size 10 µm) before use.

Note:
If necessary, the criteria in Table 4 may be met by dilution with the test water specified in clause 4.1.4.3.

(BS EN ISO 7393-2:2000, BS 6068-2.26:1986
Water quality. Determination of free chlorine and total chlorine. Colorimetric method using N,N-diethyl-1,4-phenylenediamine for routine control purposes)

4.1.4.3. Test water

Test water obtained from tap connected directly to a service pipe at main pressure.
Before collection of the water, the tap shall be flushed until temperature of the flowing water does not vary by more than 1^0C over period of 1 min and does not exceed 25^0C.

Note:
For measurement of water temperature, an instrument should be used which shows values to the first decimal place.

The test water shall be exhibit the characteristics specified in Table **5** so that it can be added directly to the test container.

Table 5 - Quality criteria for test water

Parameter	units	Minimum value	Maximum value
Total presumptive coliforms	per 100 ml	-	< 1
Bacterial colony count after incubation at:			
37^0C for 48 h	per ml	-	50
22^0C for 72 h	per ml	-	500
Phosphate	mg/l (as phosphate ion	2.0	6.7
Total oxidized nitrogen	mg/l (as N)	5.0	11.3
Free residual chlorine	mg/l (as Cl_2)	-	0.05
Total residual chlorine	mg/l (as Cl_2)	-	0.2
pH	-	6.5	9.5
Copper	mg/l	-	0.05
Silver	mg/l	-	0.01
Dissolved oxygen	mg/l	6.5	-

The conformity of the test water with the specified criteria shall be determined on the basis of analysis of samples of water drawn from a tap in the test premises after flushing. Analysis of the water shall be performed in accordance with the appropriate section of BS 6068 if none exist, with "Methods for examination of Water and Associated Materials".

The water shall be used directly from the tap or may be stored for up to 1 h prior to use. If storage is necessary the storage vessel shall be made from a suitable inert material such as borosilicate glass or polyethylene, cleaned using the procedure described in clause **4.1.5.1**, except that the final rinse water shall be at a temperature greater than 70^0C and be in contact with the inner surface of the storage vessel for a minimum of 10 min.

If the water is deficient in total oxidized nitrogen and/or phosphate, sufficient quantity of a 10 g/l solution of potassium nitrate and/or a 2 g/l solution of potassium dihydrogen orthophosphate shall be added from a graduated pipette to achieve the minimum concentrations in the test water specified in Table 03.

If the water has an excess of residual chlorine, a sufficient quantity of a fresh solution of sodium thiosulfate shall be added to neutralize the measured free residual chlorine level of less than 0.05

mg/l in the test water of laboratory grade 3 conformed to ISO 3696. Sodium thiosulfate shall not be added in excess of the required amount to the test water.

4.1.4.4. Laboratory water

Reagent -Test water, consisting of distilled or deionized water conforming specifications of Grade 3 lab water specified in ISO 3696.

Grade 3 Laboratory Water
The Grade 3 lab water specified in ISO 3696, which is suitable for most laboratory wet chemistry work and preparation of reagents solutions, should be produced, for single distillation, by deionization, or by reverse osmosis. Unless otherwise specified, it should be used for ordinary analytical work.

Note:
It is assumed that the initial feed stock water is portable water and reasonable pure. If it is heavily contaminated in any respect, some pretreatment may be necessary.

The requirements of analytical water specified as Grade 3 in the standard ISO 3696 is described and is given in the following Table 06, shown below.

Table 6 - Requirements

Parameter	Requirement	Test Method
pH value at 25^0C inclusive range	5.0 to 7.5	Sub-clause 7.1 in ISO 3696
Electrical conductivity mS/m 25^0C maximum	0.5	Sub-clause 7.2 in ISO 3696
Oxidizable matter Oxygen (O) content mg/ l maximum	0.4	Sub-clause 7.3 in ISO 3696
Absorbance at 254 nm and 1 cm optical path length, absorbance unit, maximum	Not specified	Sub-clause 7.4 in ISO 3696
Residue after evaporation on heating at 110^0C, mg/kg, Maximum	2	Sub-clause 7.5 in ISO 3696
Silica (SiO_2) content mg/l, maximum	Not specified	Sub-clause 7.6 in ISO 3696

4.1.5. Apparatus

4.1.5.1. Test containers, air tight glass preserving jars of nominal capacity 1,000 ml, fitted with glass lid and seals manufactured from a medical grade of silicone rubber.

Each container shall bear a permanent calibration mark for a capacity 1,000 ml at $(23\pm3)^0$C.
If the surface area of a sample is not in the range 13,000 mm^2 to 19,000 mm^2, a suitably sized test container calibrated in accordance with Table 07 shall be used.

The ullage (headspace) of any container shall not be exceed 15% of its total capacity.

Table 7 - Test container calibration mark

Sample surface area	**Volume indicated by calibration mark**
mm^3	ml
5,500 < to < 9,500	500
9,500 < to < 13,000	750
13,000 ≤ to < 19,000	1,000
19, 000 ≤ to ≤ 26,000	1,500

The containers, their lids and seals shall be cleaned with an aqueous solution of a biodegradable laboratory detergent, rinse in tap water and then rinsed once in laboratory water of grade 3. Following this, the containers, lids and seals shall be drained and air dried. The lid and seal shall be attached to the containers and stored until required for use.

4.1.5.2. Dissolved oxygen meter, for use with an electrochemical probe for the determination of dissolved oxygen.

The electrochemical shall be automatically temperature compensated for the solubility of oxygen in the water. The meter and probe shall be maintained in accordance with the manufacturer's instructions. Dissolved oxygen shall be measured in accordance with BS EN 25814.

4.1.5.3. Incubator/chamber, consisting of a conventional microbiological incubator or chamber calibrated to maintain $(30\pm1)^0$C with fan-assisted circulation of the internal air.

4.1.6. Samples

4.1.6.1. General

Test sample shall be conform to all the relevant requirements given in clause 3.

4.1.6.2. Reference materials

Two reference materials shall be prepared for use with each batch of samples. These shall be a positive reference of paraffin wax (microscopy grade) containing between 20 and 25 carbon atoms per molecule (melting point 50^0C to 55^0C), and a negative reference of borosilicate glass. The surface area and dimensions of each reference materials shall conform to clause 3.2.

4.1.6.3. Test water control

Use the cleaned container; after addition of the inoculum and test water this constitutes the test water control.

4.1.7. Test procedure

4.1.7.1. Preparation of the test system

4.1.7.1.1. General

On the same working day as testing is to start, soak the sample in the test water for a minimum of 10 min and then rinse the sample in flowing test water for a further 2 min to 3 min.

Note 1:

To help ensure that optimum precision and accuracy of results are obtained in any biological test the test should be in regular use within the test laboratory.

Note 2:

It is recommended that whenever possible more than two test products are tested in any one test batch.

Place each sample and reference material in separate test container. In addition include with each batch of samples one empty container which constitutes the test water control. Add inoculum water to each container, and fill with test water to the calibration mark appropriate to the sample surface area. Use a volume of inoculum specified in Table 08.

Table 8 - Volume of inoculum

Sample surface area	**Volume inoculum**
mm^2	ml
≥ 5,500 to < 9,500	50
≥ 9,500 to < 13,000	75
≥ 13,000 to < 19,000	100
≥ 19,000 to ≤ 26,000	150

If the density of the sample is less than that of water, the sample shall be kept totally submerged for the duration of the test by using glass encapsulated weights of which density is enough to hold the sample in water (see figure shown in clause 3.2). Seal each container with lid.

4.1.7.2. Sample applied to metal fittings

If a sample applied to metal fitting is included in the batch then include in the test additional container for a metal fitting reference test. Into this container an additional metal fitting but without the test sample. Add the inoculum water and test water as in clause **4.1.4**.

4.1.7.3. Incubation

Place each sealed container in an incubator in the absence of light at $(30\pm1)^0$C for the period of time given in clause **4.1.5.3**.

4.1.7.4. Assessment of microbial growth

Twice a week, decant the water from each container and then refill to the mark with fresh test water, reseal and continue the incubation. The interval between each water change shall be either 3 days or 4 days.

Measure the dissolved oxygen concentration in the water in accordance with BS EN 25814 at the following times.

a) At the time of 4-day water change;
b) During the fifth, sixth and seventh weeks of the test;
c) Immediately before the water is changed.

First determine the dissolved oxygen concentration of the water for both container with no sample, i.e. the control and the container with borosilicate glass, i.e. negative reference. Then determine the dissolved oxygen concentration of the water for each container showing no visible turbidity.

Last, measure the dissolved oxygen concentration of the water in the container showing visible turbidity. Between each reading, rinse the probe thoroughly in water conforming to grade 3 of laboratory water specified in BS EN ISO 3696. Record the values obtained in accordance with BS EN 25814/ISO 5814 (in mg/l) to one decimal place. Calculate the MDOD for each test product sample.

If the test procedures give individual values outside the specified range i.e. if the MDOD value is > 1.69 but < 2.0 mg/l continue the test for a further two weeks and then calculate MDOD using all 5 sets of results.

Record any changes in the visual appearance of the test sample(s).

4.1.8. Expression of results

4.1.8.1. Calculation of the mean dissolved oxygen difference (MDOD)

Calculate the arithmetic mean of the three dissolved oxygen values obtained from each test sample container, each of the reference tests and the test water control. Subtract the mean of each test container from the mean of the test water control. For a sample applied to a metal fitting subtract the mean the mean of metal fitting reference test (clause 4.1.7.2).

Express the resultant value for each test or reference test the MDOD in mg/l, to one decimal place. If the MDOD from the test samples container lies within the range > 1.69 mg/l to 2.9 mg/l, then test further two samples for a period of seven weeks only. Do not extend this test to 9 weeks. Calculate the mean of the three MDOD values obtained for the three test pieces during the 5th to 7th weeks of test. If the value is value is greater than 2.3 mg/l, but less than 2.4 mg/l, express the results to two decimal places.

4.1.8.2. Validation of results

Glass reference materials shall have MDOD value of (0.0±0.6) mg/l. Paraffin wax reference materials shall have MDOD value of (7.5±2.5) mg/l. the control shall have dissolved oxygen value (mean value) of (8.5±2.5) mg/l.

If any reference material or control gives results that do not conform to these values, repeat the test using fresh reagent and samples

4.1.8.3. Repeatability and reproducibility of results

When two or more identical samples of a product are examined by one analyst using same apparatus within the short time interval, it has been found that the repeatability, **r**, of the arithmetic mean is 15%. On this basis the repeatability will be exceed on average not more than once in 20 cases in the normal and correct operation of this method. When two or more identical samples of a product are examined by two operators working in different laboratories, the reproducibility, R, of the arithmetic mean is 28%. The reproducibility will be exceeded on average not more than one in 20 cases in the normal and correct operation of this method.

4.2. Test of toxicity due to EXTRACTION OF METALS

(Source BS 6920-2.6)

4.2.1. Test principle:

The metallic materials contained in non-metallic components, as constitute or impurity can leach into water when it in contact with water. Concentration made in water due to leachate mainly depend on expose surface area into water, nature of the surface, hydraulic regime and temperature. The concentration can be detected in negative control analytical test method with duplicate test samples. This test to assess the degree of leaching of metals from the non-metallic parts or coatings of valves into water.

The test is carried out in laboratory test water (reagent), on duplicate test samples. Both test samples must comply with the specifications specified in this standard. Blank test is carried out to fix the control parameter. The pH is determined in accordance with BS EN ISO 10523 and adjust to 7.0±0.1 by bubbling air and/or CO2 through the solution.

Samples of product are immersed in water for a period of 24 h; this constitutes the first extract. If necessary (see below) the same samples are immersed in test water for further six sequential extraction periods, including 72 h period and concluding with a 24 h period, using fresh water for each period. Metals are determined on the first extraction. If any concentration found for any metals exceed the specified limits, further extracts are prepared and metals are determined on the seven extracts also.

A flow diagram of the sequence of the test procedures is given in the Fig. A-2 of Annex A.

4.2.2. Reagent

4.2.2.1. Reagent -Test water, consisting of distilled or deionized water conforming specifications of Grade 3 lab water specified in ISO 3696. The description and requirement of test water is same as details given under clause 4.1.4.4 above.

4.2.2.2. Reagent - Nitric acid, concentrated (70% by mass) analytical reagent grade, suitable for use in trace metal.

4.2.2.3. Reagent - Nitric acid, 10% by volume prepared by diluting 100±1 ml of the nitric acid of 70% concentration by weight, to 11 with test water specified above in clause 4.2.2.1.

4.2.3. Apparatus:

4.2.3.1. General:

New glass and polyethylene ware shall be soaked for 2 days in nitric acid prepared above (clause 4.2.2.3) and subsequently thoroughly rinsed with test water specified above (clause 4.2.2.1).

Test containers, consisting of borosilicate glass beakers calibrated for a capacity in accordance with specification given in Table 09, shown below, with borosilicate glass covers.

Table 09: Test container calibration mark:

Sample surface area	**Volume indicated by calibration mark**
mm^2	**ml**
≥ 5,500 to < 9,500	500
≥ 9,500 to < 13,000	750
≥ 13,000 to < 19,000	1,000
≥ 19,000 to ≤ 26,000	1,500

(Source: Table 1of page 5 of BS 6920-2.1:2014, 5.1.2)

The containers shall be of a size that will allow the test sample to be placed in the container such a way as to minimize contact between the surface of the sample and the sides and bottom of the container. Before use, wash the beakers using a biodegradable laboratory detergent, rinse with the nitric acid prepared above (clause 4.2.2.3) and finally with test water Clause 4.2.2.1.

Bottle, made of polyethylene (or other suitable material known not to affect adversely the analytical results), and of a size to hold the extract period as described in either (clause 4.2.5.2.- Repeat extractions or clause 4.2.5.4- Blank Tests) as appropriate.

For mercury analysis, bottle shall be made of glass, polyethylene or polyethylene terephthalate (PET) containing a suitable preservative to ensure there is no loss of mercury awaiting analysis.

Note: 0.05% by mass potassium dichromate 1% by volume nitric acid, or gold solutions acidified with nitric acid, depending upon the nature of the bottle, are suitable for preservation purposes.

The beakers shall be washed before placing the samples, using a biodegradable laboratory detergent, rinse with the nitric acid prepared above (clause 4.2.2.3) and finally with test water Clause 4.2.2.1.

4.2.4. Test sample:

4.2.4.1. General
Test sample shall be conform to all the relevant requirements given in clause 3.

4.2.4.2. Sample cleaning
On the same day testing is to start, rinse the sample, contained in suitable sized beaker, in flowing tap water for 30 min to remove loose particulate matter and dust. Finally, rinse three times with fresh portion of the test water described above (clause 4.2.2.1).

4.2.4.3. Number of tests
Prepare duplicate samples according to details in clauses 4.2.4.1, of each product being tested and carry out the extraction procedure given in the test procedure clause 4.2.5 in each sample. If either sample exceed the concentration limits specified in Table 01 of Clause 2.2 in this standard repeat the extractions using a further three untested fresh samples.

4.2.5. Test procedure

4.2.5.1. First extraction
Immediately after cleaning (clause 4.2.4.2.), place each sample in a separate clean container (clause 4.2.3.1). Add to the container a measured volume of test water (clause 4.2.2.1.) sufficient to reach the calibration mark in the container and record the volume of water added. If the density of the sample is less than that of water, ensure the sample is kept totally submerged in the test water for the duration of the test by using glass encapsulated weights. Seal each container with glass cover. Store each container at a temperature of (23±2)0C for (24±1) h.
Remove the sample and transfer all but 50 ml of extract into a sample bottle (clause 4.2.3.1). To remaining the 50 ml of extract, add nitric acid (clause 4.2.2.2) in the ratio of 5 ml of nitric acid to every 1000 ml of total extract. Rinse the container with the acidified residual to remove any metals absorbed onto the surface of the glass and finally add this rinse to the bulk of extract in the sample bottle. Retain the acidified extract and determine the metals as described in clause 4.2.6.
If the results from both of the extracts do not exceed the concentration limits specified in Table 01 of clause 2.2, then define these first extracts as the final extracts. In these circumstances, do not carry out further extractions. If the results for either of the extracts exceed the concentration limits specified in clause 2.2, carry out the further extraction (clause 4.2.5.2.)

4.2.5.2. Repeat extractions:
Wash the container carefully to remove all traces of nitric acid and then rinse it in test water (clause 4.2.2.3.). Replace the sample.
Repeat the extraction procedure using the same volume of fresh test water in the same containers for further six sequential periods, including one 72 h period and concluding with 24 h period, discarding extracts and acidified washing each time.
If for logistical reasons, a break in the extraction sequence is essential, store the test samples dry in clean food grade polyethylene bags until the sequence can be continued.

4.2.5.3. Final extract:

Remove the sample and transfer all but 50 ml of extract into a sample bottle (clause 4.2.3.1). To remaining the 50 ml of extract, add nitric acid (clause 4.2.2.2.) in the ratio of 5 ml of nitric acid to every 1000 ml of total extract. Rinse the container with the acidified residual to remove any metals absorbed onto the surface of the glass and finally add this rinse to the bulk of extract in the sample bottle. Retain the acidified extract and determine the metals as described in clause 4.2.6.

4.2.5.4. Blank Tests:

Carry out a blank extraction procedure (regent blank) following the procedure described in clause 4.2.5.1. and clause 4.2.5.3. but omitting the sample.

Perform reagent blank test to provide information on the effect of the container or possible ingress of contaminants from external sources.

If sample applied to a metal fitting is being tested, then test and identical cleaned metal fitting but without the product under test, as a metal fitting blank test. Carry out on this metal fitting all the procedures given in clause 4.2.5.1., clause 4.2.5.2. and clause 4.2.5.3., and also carry out a reagent blank test.

4.2.5.5. Validation (reagent blank)

If the reported concentration for any metal in the reagent blank exceeds the appropriate reporting limit given in Table 01 under clause 2.2 of this standard, but is less than 25% of the maximum allowable concentration (MAC) given in Table 2 under clause 3.3 of this standard for the metal, carry out an investigation to determine the cause of the exceedance. Keep a record of these investigations. Include an examination of the concentrations for the blank to ensure that they are within the total error of the analytical method(s) and do not indicate any quality control difficulties. Evaluate the validity of test sample results as follows.

a) Where the results for the blank exceed the appropriate reporting limits given in Table 01 under clause 2.2 of this standard then the results for final tests sample extract are accepted as valid;
b) Where the results for the blank exceed the appropriate reporting limits given in Table 01 under clause 2.2 of this standard and are greater than 25% of the MAC, then the test results for the final sample extracts are in valid;
c) Where the results for the blank exceed the appropriate reporting limits given in Table 01 under clause 2.2 of this standard but are less than 25% of the MAC and the results for the final test sample extracts are less than 50% of the MAC, then the test results are accepted as valid;
d) Where the results for the blank exceed the appropriate reporting limits given in Table 01 under clause 2.2 of this standard but are less than 25% of the MAC and the results for the final test sample extracts are greater than 50% of the MAC, then the test results are invalid.

NOTE 1: Around the limit of detection small positive values can be obtained from statistical variation, minor sample contamination and actual concentration variations.

NOTE 2: It is very unusual to find a reported difference between two identical sample extracts. Due to the method of extract preparation, however, the results obtained from “identical” test samples can vary as a results of surface contamination of the test pieces, contamination in container, or sample collection bottle.

4.2.6. Determination of extracted metals

4.2.6.1. Analytical methods

Determine the presence of metals listed in Table 01 under clause 2.2 of this standard in the final extracts (clause 4.2.5.1. or clause 4.2.5.3. as appropriate.)

Choose the analytical method such that total error of an analytical result does not exceed either 10% of the relevant value given in the table or 20% of the result, whichever is greater. Ensure that the requirements for the random and systematic error are such that they each do not exceed one half of the tolerable total error as defined in this paragraph.

Note 1: for an introduction to the concepts of random, systematic and total error in water analysis, following publication be consulted.

a) General principles of sampling and accuracy of results in the series methods for examination of waters and associated materials;
b) Water research centre. A manual on analytical quality control for the water industry.
   For the determination of metals, where possible use a method given in BS 6068-2 that meets these criteria.

For the determinations of those metals not covered in BS 6068-2, use the method meeting these criteria from Methods for the Examination of Waters and Associated Materials.

Note 2: In determining the extracted metals content, dilutions of the extract may be made in order to bring the metal concentrations within the range of the particular analytical technique. Any dilution should be taken into account when calculating the original concentration of the metal in the extract.

4.2.6.2. Validation

Collect control data reagent blanks, duplicate and “spikes” to provide information on background contamination, and on analytical precision and accuracy of the methods used during analysis of each batch extracts. For “spikes” choose concentrations that are representative of the concentrations encountered in the test samples.

4.2.7. Expression of results

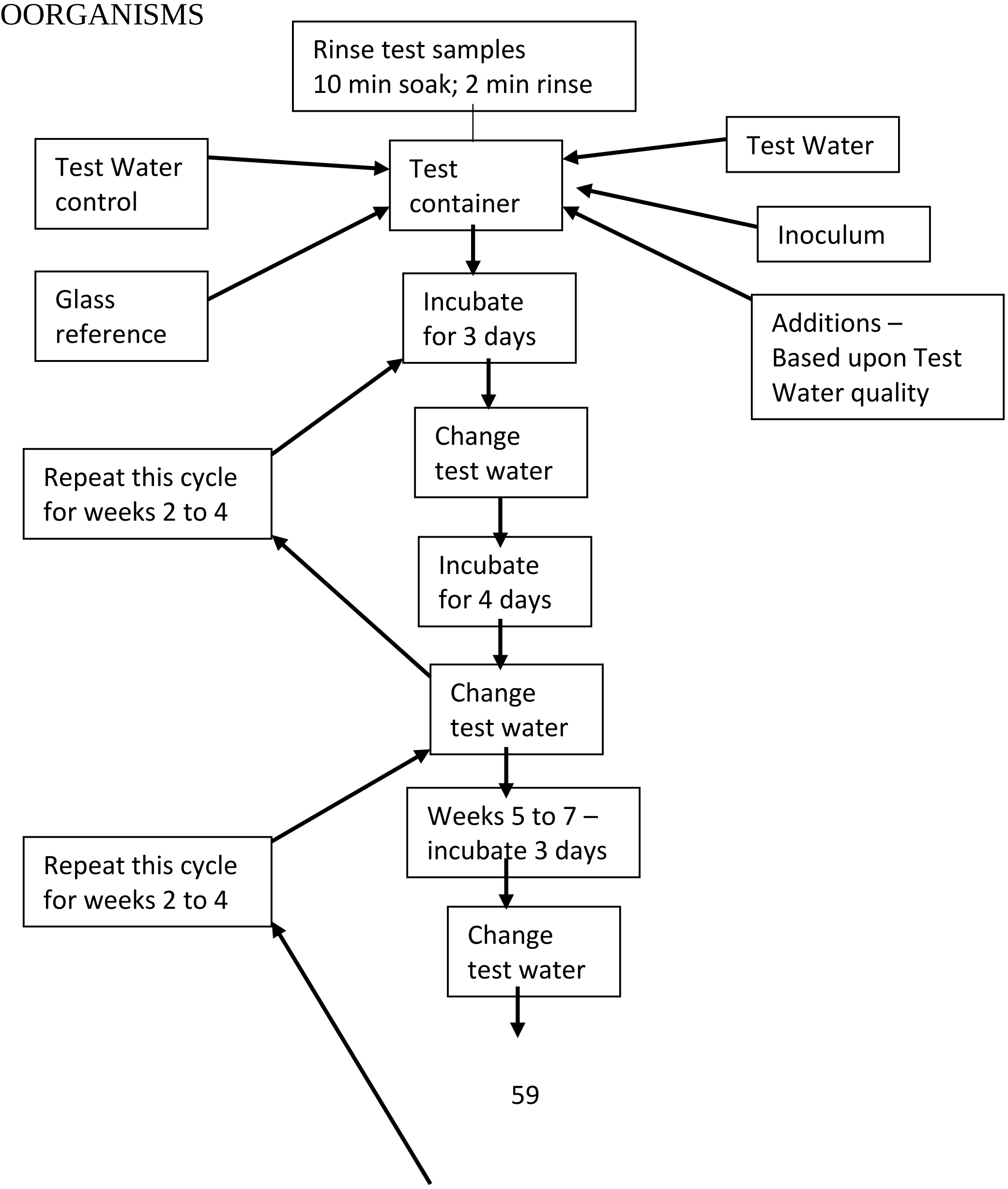
Record the concentration of each metal determined in all the extracts tested (in µg/l), applying a correction factor for the volume of acid added to the final extracts (see clause 4.2.5.1. or clause 4.2.5.3. as appropriate).

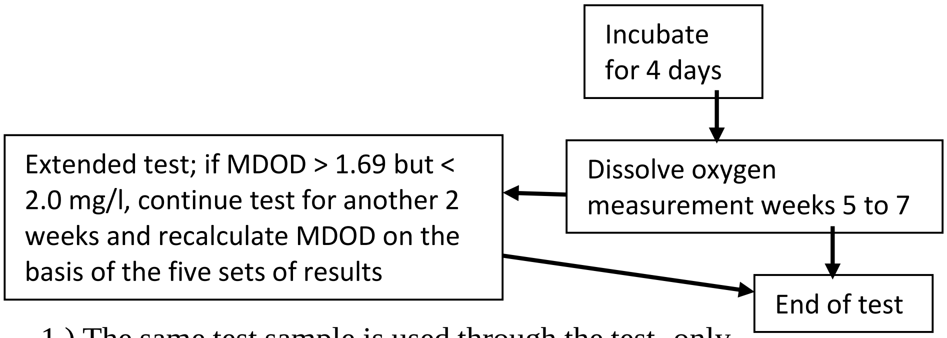
Record the concentration of each metal determined in the test blank.

When metals are not detected in either the sample extract or the blank, record the results as being less than the limit of detection for the analytical method used.

When sample has been tested applied to a metal fitting, subtract from each concentration of each metal determined in the final extract the corresponding value determined for the metal fitting blank test (see clause 4.2.5.4.). Record both sets of values and the differences.

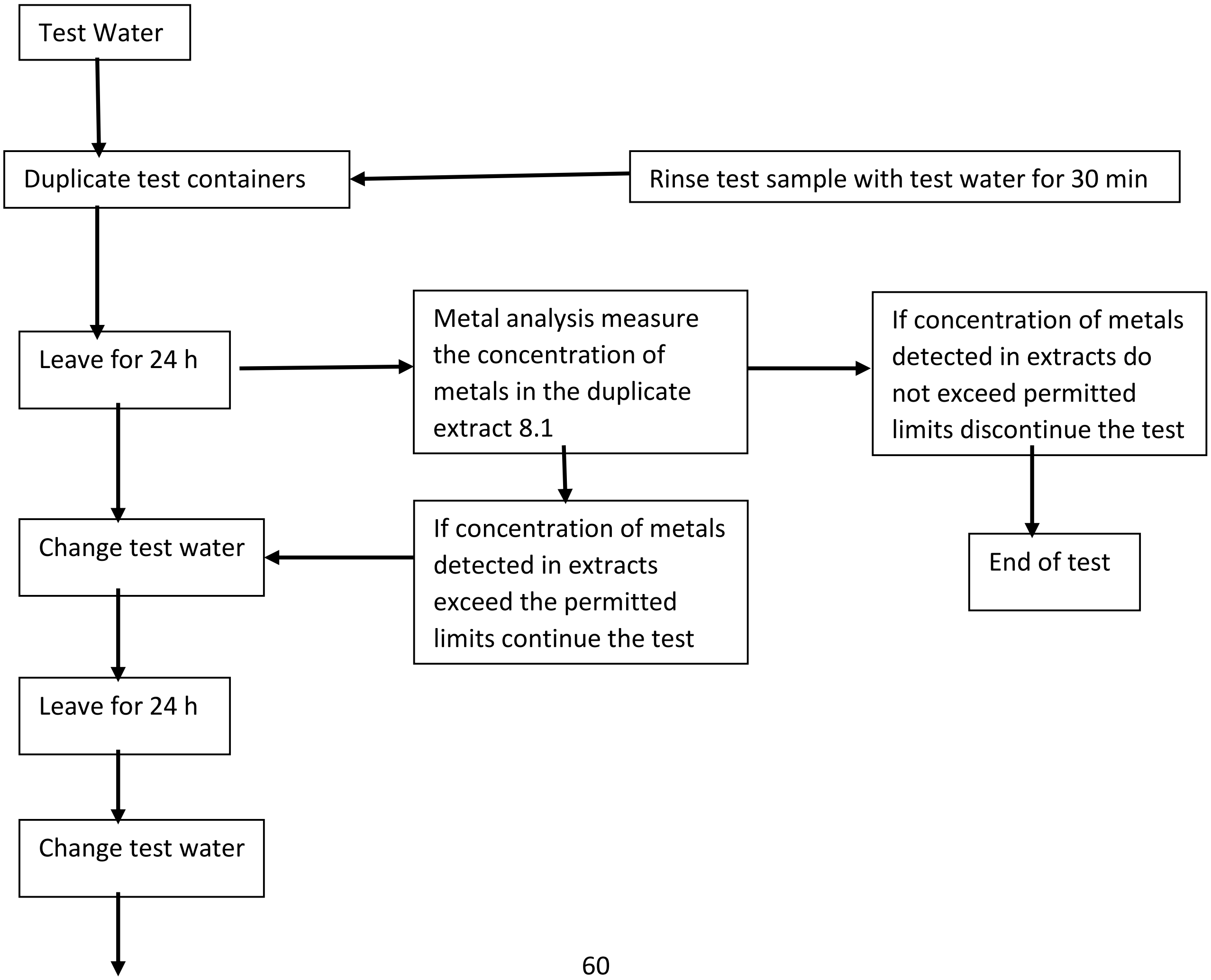
Fig. D-1: Flow diagram - the sequence of the test procedure GROWTH OF AQUATIC MICROORGANISMS

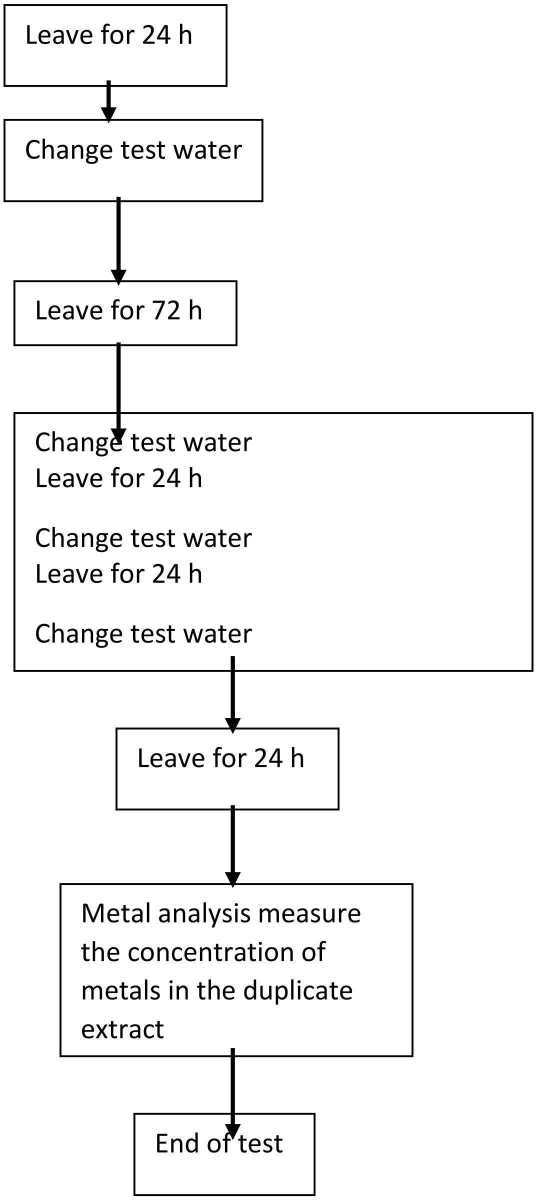




1.) The same test sample is used through the test- only the water is changed.
2.) If two further samples are tested do not extend the test period for these samples.
3.) the incubation intervals three and four days may be reversed to assist the organization of this test, however the dissolved oxygen measurements are always made at the end of the four day incubation period.

Fig. D-2: Flow diagram - the sequence of the test procedure of EXTRACTION OF METALS





Deviation of reading of caliper:

Support the caliper along the side of the beam with the jaws horizontal. Measure the separation of external measuring faces by combinations of calibrating gauge blocks and other end gauges or by other means of similar accuracy such as a length measuring machine. Check the deviation of reading at a minimum of at least five approximately equally spaced positions which cover the measuring range of the main scale and the Vernier scale.

Take care to ensure that the method of measurement of the separation of the measuring faces does not distort the caliper. Take care, also, particularly on the longer separations, to ensure that the caliper and measuring equipment, have stabilized at 20^0C and that differences in temperature are not introduced by handling while carrying out the measurements.

APPENDIX E

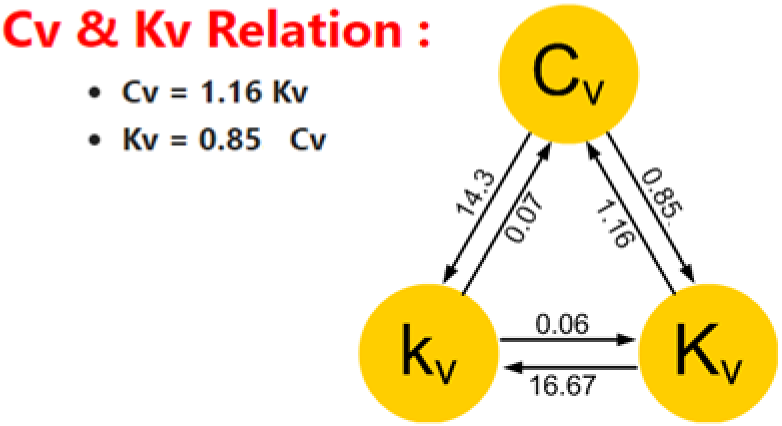
Test of flow coefficient

Test method is based on the test procedure given in EN 1267. Test is carried out using potable water at ambient temperature.

Hydraulic circuit having facility to maintain constant test flow and pressure across the test valve and of adjusting pressure drop across the test valve in order to obtain series of measured readings of flow rate against different setting of pressure drop across the test valve. By plotting the graph of relationship of the pressure drop against the flow, the value of K_V can be fixed, as illustrated in Fig. E.2 below. Typical hydraulic circuit for the test is shown as in the schematic diagram Fig. E.1 below.

In concern with isolating ball valves, only one value for C_v can be fixed. This is the value obtained at full open position of the isolating ball valve. This is the C_v value of the ball valve referred in this standard.

In case of manufacturer has given the flow coefficient in gpm(US) per psi or l/min per one kgf/cm^2, these can be converted into m^3/h per one bar with the converting factors shown in triangular diagram illustrated below.



Cv & Kv Relation :

- Cv = 1.16 Kv
- Kv = 0.85 Cv

Kv (with a capital K) expresses the flow rate in m^3/hour,
kv (lowercase) in l/min.

Conversion factor for SI unit is given by as follows. For SI unit pressure drop is in kgf/cm2

$$K_v\ (SI) = 0.856\ C_V$$

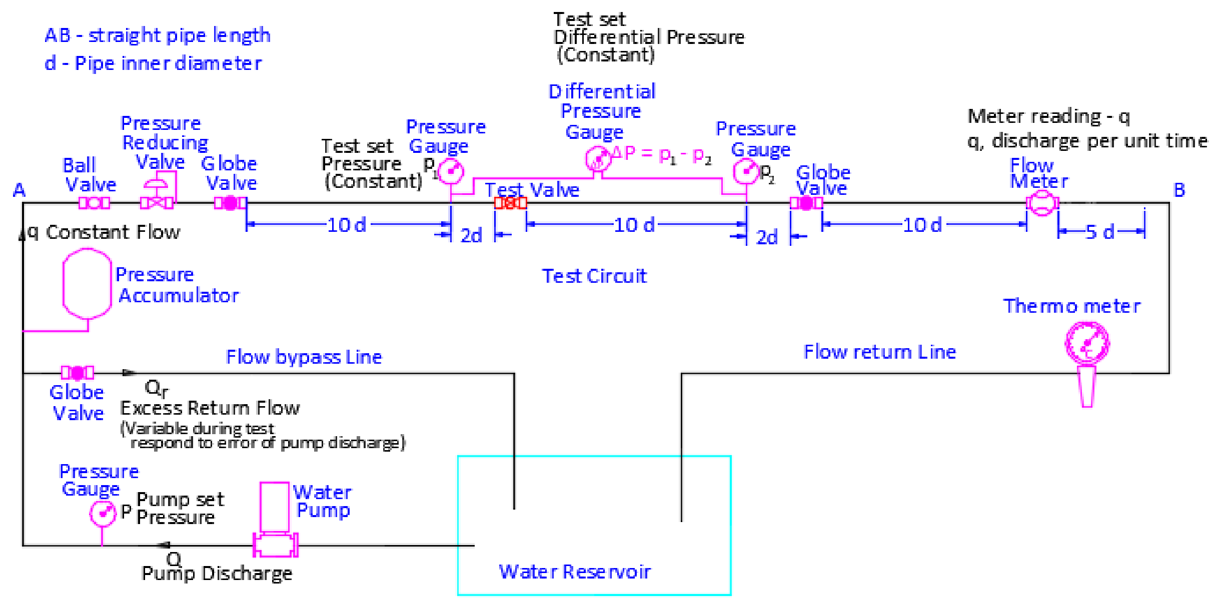


Fig. E1: Schematic Diagram of Hydraulic Circuit for Flow Test

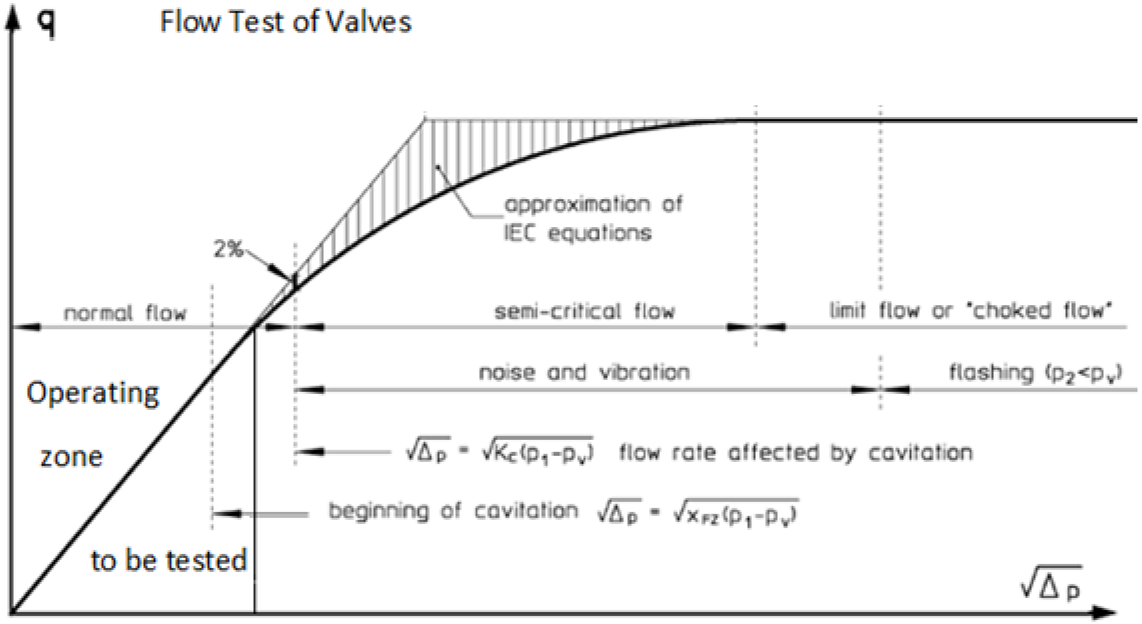

Flow Test of Valves

Fig. E.2 – Flow rate diagram of an **incompressible fluid** flowing through a valve plotted versus Pressure drop across the valve under constant upstream conditions.

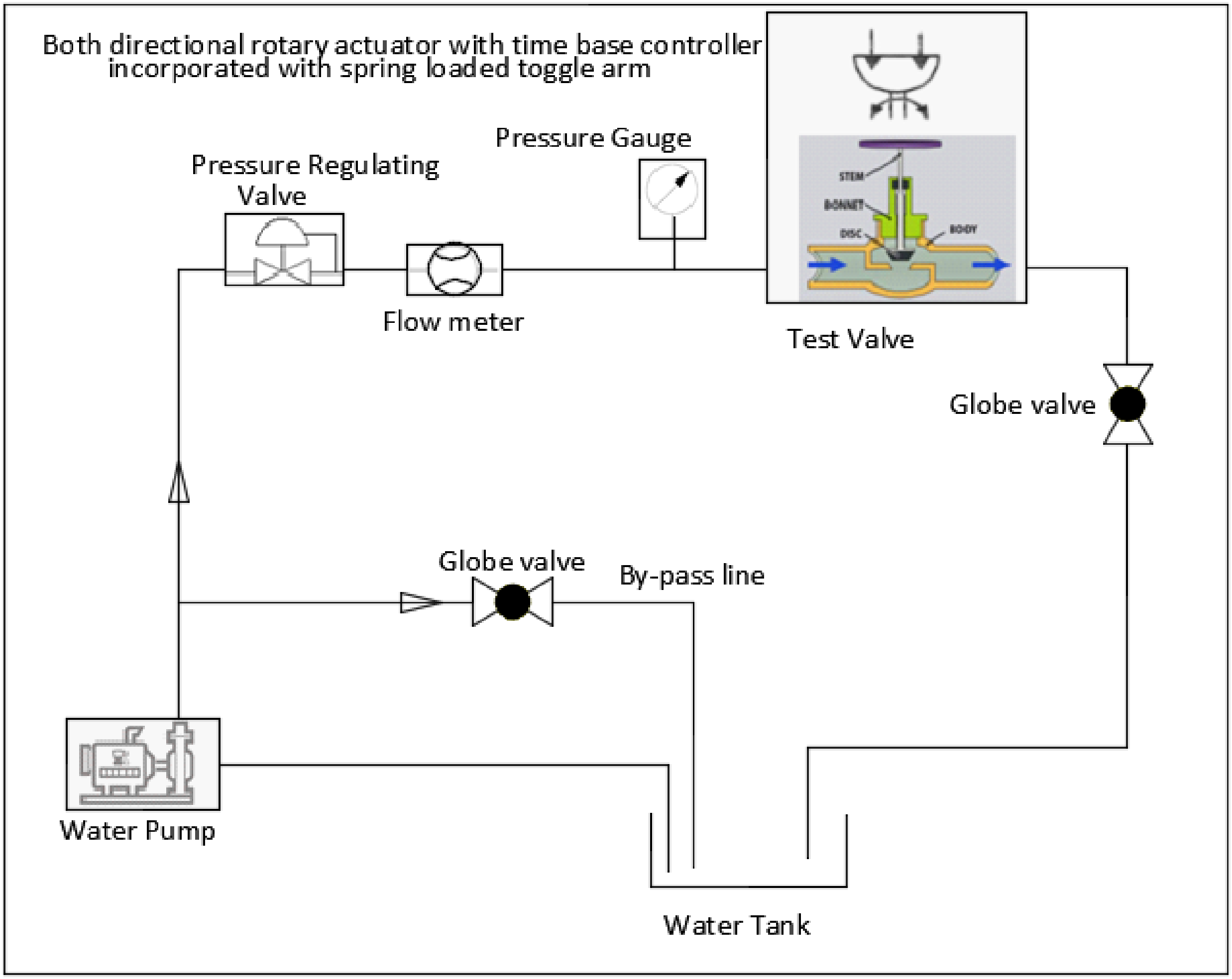
APPENDIX F

Endurance Test for the valves

1. Test apparatus

Test apparatus shall be designed to
An automatic test rig having that the adjustable torque application facility greater than 3 Nm, and set torque shall be remained constant and is not effected by the influence of the moment of inertia of the equipment during test.

Equipment related forces that act horizontally or vertically onto the headwork (top of the stem or operating device) and might result in abnormal wear ought to be eliminated. A frictionless connection to the operating spindle shall be ensured. Line diagram of typical test rig is shown below.



2. Test Condition

Application of the torque on the headstock for opening and closing of the test valve shall be (2.5 ± 0.5) Nm. The flow rate through the test rig and pressure at inlet and outlet of the test valve shall be able to adjusting to different levels up to 10 l/s and 1 MPa (10 bar) respectively.

3. Procedure

Installed the test valve on automatic test rig similar to typical test rig shown in above figure.

Apply closing torque of (2.5±0.5) Nm during the test. With the test valve in the closed position adjust the static pressure to between 0.2 MPa and 0.4 MPa (2 bar and 4 bar). With the test valve in the open position adjust the flow rate to between 0.066 l/s and 0.1 l/s, by the regulation valve installed downstream of the test valve.

Above test is subjected to the following operational sequence.

- Opening at least 75% of the full lift, but not to reach 95% of full lift;
- Holding for about 5 s of open position in flowing mode;
- Closing completely with the torque of 2.5 Nm (test valve does not need to be drip-tight closed positon)
- Hold about 5 s in closed position.

The test is applied to the test valve as in flow delivering condition.

If the test valve does not operate with indicated closing torque after this procedure, the requirements of the test have not been fulfilled.

Adjustable gland packing retightened during the test.

After completion of the above operation sequences;

- Store the valve for one week at ambient temperature in open position;
- Then store the valve for one week at ambient temperature in closed position;
- Repeat the tests for operating torque and leak tightness as detailed in clauses **7.4.3** and **7.5** in the standard respectively.

NOTE: While progressing the test, if any leakage or malfunction found at any stage, test shall be stopped.

4. Acceptance criteria

a) During the test, if leakage or malfunction found at any stage, the product shall deemed to be unsatisfactory.

b) Acceptance criteria specified for operating torque and leak tightness as detailed in clauses 7.7.3 and 7.8 in the standard respectively shall be applied for the repeat test check the compliance requirements.