भारतीय मानक

पानी के मीटर के निष्पादन जांच के तरीके (घरेलू किस्म)

(दूसरा पुनरीक्षण)

Indian Standard

METHODS FOR PERFORMANCE TESTING OF WATER METERS (DOMESTIC TYPE)

(Second Revision)

ICS 17.120.10

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Price Group 4

FOREWORD

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

This standard was first issued in 1973 and subsequently revised in 1984. In view of the sixth revision of IS 779 'Specification for water meters (domestic type)' in 1994, the revision of this standard also became necessary.

In the revision of this standard, considerable assistance has been derived from ISO 4064 (Part 3) : 1983 'Measurement of water flow in closed conduits — Meters for cold water — Part 3 Test method and equipment'.

The composition of committee responsible for the preparation of this standard is given in Annex B.

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, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

METHODS FOR PERFORMANCE TESTING OF WATER METERS (DOMESTIC TYPE)

(Second Revision)

1 SCOPE

This standard lays down the methods of tests for the performance requirements of water meters covered in IS 779 : 1994.

2 REFERENCE

The Indian Standard IS 779 : 1994 'Specification for water meters (domestic type) (*sixth revision*)' is a necessary adjunct to this standard.

3 TEST EQUIPMENT AND TEST SET-UP FOR PRESSURE TIGHTNESS, METERING ACCURACY AND LOSS OF PRESSURE

3.1 Test Equipment

The main equipment (*see* Fig. 1) required for testing is as follows:

a) Pump set (centrifugal) and/or overhead tank,
b) Mercury manometer or pressure gauges and/or differential pressure gauge,
c) Measuring tanks with level indicator,
d) Sluice valves or gate valves,
e) Stop watch or electronic timer, and
f) Rotameter.

3.2 Test Set Up — *See* Fig. 1.

3.2.1 *Test Bench*

A centrifugal pump or any other suitable arrangement to ensure the required differential head and discharge, may be used. The pump, where used, should have a stable head discharge characteristics and should be free from cavitation effects. Constant suction condition arrangements are necessary to avoid discharge variation during the testing. The pump which can give more than the specified delivery head [required to test meter(s) in series], and discharge value can also be used. Proper precautions and arrangements should be made to dampen the vibrations by taking care about the alignment of pump and meter coupling by making suitable flexible joints between the pump delivery line and meter connections. Supports shall be provided at suitable intervals on pipe lengths. The pump connections to the testing set-up are to be made with a gate valve E and mercury manometer or pressure gauge and/or differential pressure gauge as shown in Fig. 1. It is recommended to run the pump at its maximum efficiency and control the discharge to the testing set-up by means of a bye-pass arrangement.

3.2.1.1 A bye-pass arrangement with connecting line to the meter gives a steady flow dampening small fluctuations. Any other method of dampening fluctuations may also be used. This is absolutely necessary in the case of the minimum starting flow test and metering accuracy test. This arrangement may not be required where separate test bench is used for conducting the minimum starting flow test and the metering accuracy test. Any other method of controlling flow may then be used.

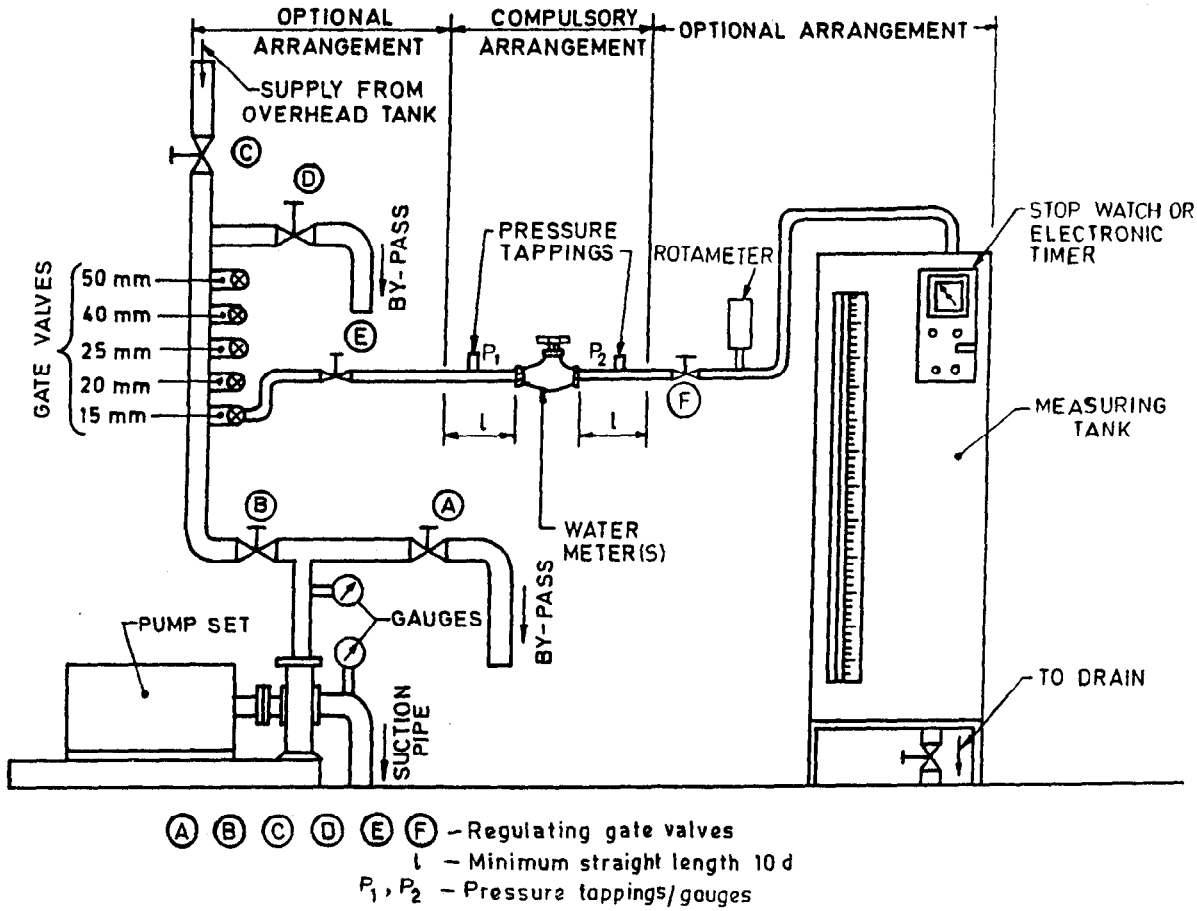
3.2.1.2 The capacity of the pump should be determined based on the number of meter(s) proposed to be tested in series. The pump should be capable of delivering water more than Q_{max}, through 1 or N number of meters (where N is the numerical number of meters being tested in series), at a delivery head more than the sum of pressure loss as under:

Delivery head of pump at a discharge higher than Q_{max} specified for a particular size of meter	Sum of pressure loss through 1 or N number of meters plus pressure loss in spacers of 10 D length provided on either side of 1 or N number of meters plus back pressure registered at the end of the test equipment by pressure gauge P_2 + other line losses

3.2.1.3 Other suitable arrangements for testing by direct connection to pressure main or using overhead tank may also be used.

3.2.2 *Connections*

3.2.2.1 The main connection shall be made from a centrifugal pump or by any of the alternative



NOTE — By operating the appropriate valves, the set-up can be connected either to the overhead tank or to the pump-set. It is advisable to provide a pressure gauge near the delivery line and a control valve for initial starting of the pump.

FIG. 1 A TYPICAL WATER METER TESTING SET-UP

arrangements specified under 3.2 which can create the required differential head between the meter terminals and give a discharge greater than the maximum capacity requirements. Where connection is taken from an overhead tank, a constant level should be maintained.

3.2.2.2 The gate valve *E* shall be fixed at a minimum distance of 15 times the bore diameter of the pipe connecting the meter to act as a main control.

3.2.2.3 The gate valve *F* may be used for finer adjustment of discharge rate with the help of manometer or pressure tapping/gauge P_2.

3.2.2.4 In case, if more than one meter is to be used, the straight length of pipe between two meters both upstream and downstream shall not be less than 10 *D*, where *D* is the bore diameter of pipe.

3.2.3 *Measuring Device*

Any suitable means may be used for measuring the discharge from water meter. Measuring tank if used, shall be capable of collecting the following minimum quantity of water:

Flow Rate (litre/h)	*Quantity of Water* (litres)
Up to and including 200	10
201 - 500	20
501 - 1 000	50
1 001 - 5 000	100
5 001 - 10 000	200
10 001 - 20 000	500
20 001 - 30 000	1 000

Least count of the measuring tank in the final 10 percent of the water collection shall conform to the verification scale given in Table 1 of IS 779 : 1994.

3.2.4 *Location of Pressure Tapping*

The upstream and downstream tapping from the meter to the manometer/pressure gauges/differential pressure gauge shall be at the following distances :

Nominal Size of Water Meter	*Tapping Distance from the Water Meter*
(mm)	(Tolerance ± 0.1 *d*)
15	8 *d*
20	7 *d*
25	6 *d*
40	4 *d*
50	4 *d*

Where '*d*' is the bore diameter of the pipe connecting the meter.

3.3 Alternative Equipment for Pressure Tightness Test

The pressure tightness test, alternatively may be carried out using hand pumps, reciprocating pump or any other suitable means, like pressure intensifier and dead weight pressure gauge tester.

4 TEST EQUIPMENT FOR TEMPERATURE SUITABILITY TEST

For carrying out the temperature suitability test, a container of appropriate dimensions fitted with heating elements, and temperature control device to maintain temperature at 45°C ± 1°C shall be used.

5 TEST EQUIPMENT FOR LIFE TEST

The test equipment shall consist of the following:

a) A centrifugal pump along with regulating valves capable of delivering water at the rate of Q_n through two water meters in series,
b) A suitable horizontal test bench, and
c) A pressure gauge of appropriate range.

6 FLOW TESTS

6.1 Metering Accuracy Test

After preliminary running and setting, allow the water to pass through the meter in such a way that flow rates corresponding to the values given in Table 3 of IS 779 : 1994 for Q_{max}, Q_t, Q_{min} and in Table 2 of IS 779 : 1994 for Q_n are achieved. This may be accomplished by manipulating the inlet valve or outlet valve for finer adjustment. For each of the flow rate the reading on the meter(s) shall be taken both at the start and end of the test and the volume of water thus registered by the meter shall be compared with the volume collected in the measuring tank. The test shall be carried out separately for each of the flow rates, as stipulated in IS 779 : 1994.

The error shall then be computed as under:

$$\text{Percent error} = \frac{V_1 - V_2}{V_2} \times 100$$

where

V_1 = volume of water collected in the water tank, and
V_2 = volume of water indicated on individual meter.

6.1.1 Metering accuracy shall be calculated and reported separately for the following discharges:

a) Q_{max},
b) Q_t, and
c) Q_{min}.

NOTES

1 The metering accuracy test at Q_n may be done if required by the purchaser.

2 Recording of volume of water in the meter at Q_{min} shall be deemed as meter complying with the 'minimum starting flow test'.

6.2 Loss of Pressure Test at Q_n and Q_{max}

6.2.1 This test may be carried out concurrently with the metering accuracy test at Q_n and Q_{max}.

6.2.2 The meter shall be tested for loss of pressure within the meter at nominal flow rate Q_n and maximum flow rate Q_{max}. The loss of pressure should not exceed 0.025 MPa and 0.1 MPa respectively at the above two stages. (For value of Q_n and Q_{max}, IS 779 : 1994 may be referred).

6.2.2.1 The pressure loss within the meter may be measured with the help of manometer or differential pressure gauge or pressure gauges provided each at upstream and downstream.

6.2.2.2 While the meter(s) are being tested for accuracy at Q_n and Q_{max}, the readings between the upstream and downstream in the pressure gauges P_1 and P_2 or manometers shall be taken for the purpose of computing the value of loss of pressure within the meter. In case one meter is being tested the difference between the pressure gauge reading of P_1 and P_2 or the differential pressure shown by the differential pressure gauge/manometer shall be the loss of pressure within the meter.

6.2.2.3 In case loss of pressure is being measured for more than one meter at a time, the difference between the readings of P_1 and P_2 be divided by number of meters to obtain the loss of pressure in an individual meter. This, however, shall contain the line loss(es) contributed by the connecting pieces between the two meters. For an accurate

approach line loss(es) may be measured by joining the up and downstream spacers/pipe faces together in the absence of the meter/s (carefully avoiding protrusion into the pipe bore or misalignment of the two faces), and measuring the pipe pressure loss/line losses of the measuring section for each test at appropriate flow rates.

6.2.2.4 While computing loss of pressure, across 1 or N number of meters tested in series, the loss registered by spacers/pipes/in line losses be subtracted from the total value of pressure loss registered by difference between the readings of pressure gauge at upstream and downstream to obtain the value of loss of pressure across 1 or N number of meters.

7 PRESSURE TIGHTNESS TEST

7.1 The meter(s) shall be subjected to hydrostatic continuous water pressure of:

a) 1.6 MPa for 15 minutes, and
b) 2.0 MPa for 1 minute.

NOTE — Only when the meter has qualified for (a) above, it should be subjected for the test for (b) above.

7.2 After mounting the meter(s) on the test bench as specified in **3.2.1** the pump or the pumping medium should be switched on to let the water flow through the meter(s) and the air is purged out of the system. The downstream valve should then be closed. The pressure shall then start building up and should be maintained at the above value for the given time. The meter should withstand constantly the above pressure without defects in its function, leakage, seepage or permanent deformation.

NOTE — The meter(s) may be tested individually or in series.

8 TEMPERATURE SUITABILITY TEST

8.1 As a general rule, at least one meter shall be put to temperature suitability test every three months and records maintained. The meter for test may be selected at random.

8.2 The meter which has qualified the technical and metrological characteristics in accordance with IS 779 : 1994 shall be taken and placed in the test equipment meant for temperature suitability test maintained at 45°C ± 1°C. It should be kept there for 10 hours. While the meter is immersed in water dust cap or device stopping entry of water inside wet chamber of the meter be removed.

8.2.1 After 10 hours of continuous immersion at 45°C ± 1°C the meter shall be taken out and kept for some time in the open to acclimatize it at the ambient temperature. It shall then be tested again for flow tests (*see* **6**) and pressure tightness test (*see* **7**). They shall be deemed satisfactory if their performance after the temperature suitability test satisfies the above requirements.

NOTE — In case any material/design changes are carried out, this test shall be performed and checked for satisfactory performance before introducing the change(s) on mass scale production.

9 LIFE TEST (ACCELERATED ENDURANCE TEST)

9.1 Two unopened meters in each size and class, selected at random shall be subjected to the life test every six months, in accordance with the requirements specified in Table 1 .

NOTE — Meter(s) may be tested individually or in series.

Table 1 Life Test Requirements

Nominal Flow Rate	Test Flow Rate	Type of Test	No. of Interruptions	Duration of Pauses	Period of Operation at Test Flow-Rate	Duration of Start Up and Run Down
Q_n kl/h				s		s
(1)	(2)	(3)	(4)	(5)	(6)	(7)
≤ 10	Q_n	Discontinuous	100 000	15	15 s	$0.15(Qn)^{1)}$ with a minimum of 1 s
	$2Q_n$	Continuous	—	—	100 h	—
>10	Q_n	Continuous	—	—	800 h	—
	$2Q_n$	Continuous	—	—	200h	—

[1] Q_n is the number equal to the value of Q_n expressed in kl/h.

9.2 After the meters having undergone the life test, they shall again be subjected to flow tests (*see* **6**) and pressure tightness test (*see* **7**). They shall be deemed satisfactory if their performance after the life test satisfies the above requirements.

9.3 One of the meter which has undergone the life test (preferably the one that has shown greater deterioration in its performance under the flow test) shall be dismantled completely and examined with a view to ensuring that there is no undue wear or distortion. Particular attention shall be paid during examination to the wear of the actuating unit comprising vane wheel or piston, the impeller shaft and measuring chamber, bearings, gears and pinions, pivots and the gland packing.

10 TEST REPORT

The test report of a meter shall be compiled in the form as given in Annex A.

ANNEX A

(*Clause* 10)

TEST REPORT FOR WATER METER

Meter makers/Suppliers	Type: Class: Size :	Inf/Semi positive O, A or B — mm	Meter No.
_____			_____

A. PERFORMANCE		REMARKS
1. At Q_{max}		
i) Maximum flow rating of meter	:	
ii) Minimum discharge with pressure loss not exceeding 0.1 MPa	:	
iii) Pressure loss	:	
iv) Error in metering accuracy	:	
2. At Q_n		
i) Nominal flow rating of meter	:	
ii) Minimum discharge with pressure loss not exceeding 0.025 MPa	:	
iii) Pressure loss	:	
iv) Error in metering accuracy	:	
3. At Q_t		
i) Transitional flow rating of meter	:	
ii) Error in metering accuracy	:	
4. At Q_{min}		
i) Minimum starting flow rating of meter	:	
ii) Error in metering accuracy	:	
5. Pressure tightness test at		
i) 1.6 MPa for 15 minutes	:	
ii) 2.0 MPa for 1 minute	:	
6. Temperature suitability test		
(Report performance 1 to 5 above)		
7. Life test		
(Report performance 1 to 6 above)		
B. CONSTRUCTION		
1) Before dismantling (**7** of IS 779 : 1994)		
2) After dismantling (**12.4.3** of IS 779 : 1994)		
C. DIMENSIONAL VERIFICATION		
D. VERIFICATION SCALE INTERVAL		
E. MARKING		

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Sanitary Appliances and Water Fittings Sectional Committee, CED 3

Chairman	*Representing*
SHRI S. PRAKASH	Delhi Water Supply & Sewage Disposal Undertaking (MCD), Delhi
Members	
SHRI P. K. JAIN (*Alternate* to Shri S. Prakash)	
ADVISER (PHE)	Central Public Health & Environmental Engineering, New Delhi
DEPUTY ADVISER (PHE) (*Alternate*)	
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SHRI SANJAY AGGARWAL (*Alternate*)	
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SHRI ARUN KANTI BISWAS	National Environmental Engineering Research Institute (CSIR), Nagpur
CHIEF ENGINEER (RURAL)	Maharashtra Water Supply & Sewage Board, New Bombay
DR T. K. DAN	Central Glass & Ceramic Research Institute (CSIR), Calcutta
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DY HYDRAULIC ENGINEER (*Alternate*)	
SHRI D. K. KANUNGO	National Test House, Calcutta
SHRI R. KAPOOR (*Alternate*)	
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SURVEYOR OF WORKS (NDZI) (*Alternate*)	
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SHRI VINOD KUMAR, Director (Civ Engg)	Director General, BIS (*Ex-officio Member*)

Member Secretary
SHRI R. S. JUNEJA
Joint Director (Civ Eng), BIS

(*Continued on page 8*)

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Water Meters Subcommittee, CED 3 : 4

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SHRI M. L. BHANSALY	Rajkamal Water Meter Mfg. Co, Calcutta
SHRI K. S. BHANSALY (*Alternate*)	
DR D. K. BISWAS	Central Mechanical Engineering Research Institute (CSIR), Durgapur
SHRI NARESH BOHRA	Rajasthan Industrial & Scientific Corporation, Jaipur
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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

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TO
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(Second Revision)

(*Page* 3, *clause* **6.1**, *formula*) — Substitute the following for the existing formula:

$$\text{Percent error} = \frac{V_i - V_c}{V_c} \times 100$$

where

V_c = value accepted as true of the volume passed, and

V_i = volume indicated by the water meter at the time of measurement of the same volume both expressed in the same units.

(*Page* 3, *clause* **6.2.2.2**, *last sentence*) — Delete.

(CED 3)

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