# METERS

## INTRODUCTION

A water meter is a scientific instrument for accurate measurement of quantity of water distributed to the consumers. It also fulfils the need to know accurately the water produced and distributed.

# METER INSTALLATION

## Sizing of Meters

- Water meter has to be selected according to the flow to be measured and not necessarily to suit a certain size of water main.
- The maximum flow shall not exceed the maximum flow rating.
- The nominal flow shall not be greater than the nominal flow rating.
- The minimum flow to be measured shall be within the minimum starting flow of the meter.
- Low head loss, long operating flow range, less bulky and robust meter shall be preferred.

## Meters associated fittings

Additional to the quality meter purchased, the following fittings and instructions should be applied and followed additionally, in order to ensure the correct functioning of water meters.

- Use gaskets that properly match the diameter of meters. Instrumental errors may occur when gaskets are projecting inwards.
- Threaded meters shall be installed using meter liners/connectors.
- A stopcock or valve, preferably with the direction of the valve operation indicated, should be installed upstream and downstream of the meter.
- In case of high probability of tampering of the downstream stopcock valve, a non-return valve shall be installed instead.
- If, under specific installation conditions, the accuracy of flow measurement is likely to be affected by suspended particles in the water, the meter may be installed with an additional external strainer. The strainer shall be placed before the stopcock valve in the pipe work upstream.
- For correct operation, a water meter shall be installed such that it is completely filled with water under normal conditions. If there is a risk of air entering the meter, as it is the case when water supply is rationed, an upstream air release valve shall be installed between the upstream stopcock valve and the meter itself.
- The difference in height between the lowest draw-off point of water after the meter and the water flow meter shall be not less than 10 times the diameter of the respective pipe.

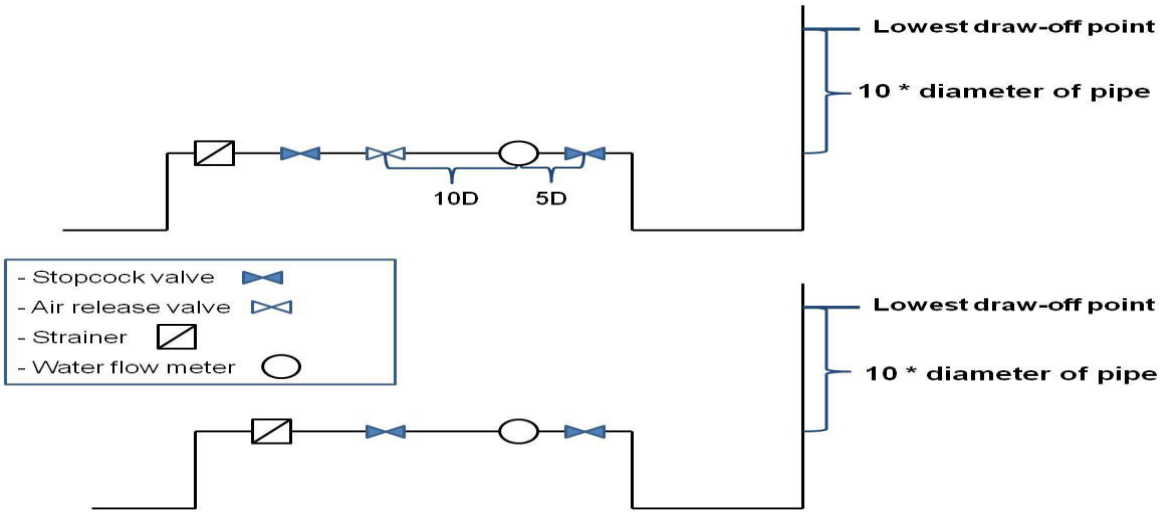



Fig1. **Correct installation of associated fittings**

**General recommendations**

Installation of water meters shall be carried out professionally according to the installation instructions provided by the specific manufacturer. Additionally, the following recommendations should be followed:

- Install meters horizontally at the designated location, with the arrow (typically shown on the lower case) facing towards the direction of the flow of meter. The meter shall be installed in a 90° angle to the meter flow and with the indication device facing upwards

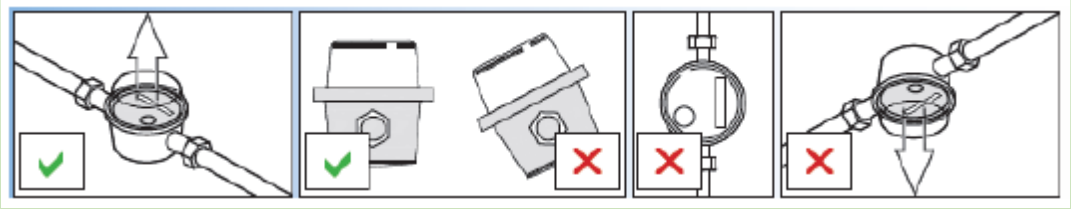


**Fig2: Comparison of correct and wrong installation of water meters**

**General recommendations continued**



Fig 4: Left: velocity meters installed incorrectly (vertically); right: displacement (rotating-piston) which can be installed vertically, but preferably not.



Fig 5: Velocity meter installed horizontally (correct) but too close to the up- and downward bend

- Provide a straight pipe length equivalent to 10 times the diameter of the meter upstream and 5 times the diameter of the pipe downstream (10D/5D rule-of-thumb). This is indicated in Figure 2.
- Water meters shall be easily accessible for reading, for installation, for maintenance, for removal and for in situ dismantling of the mechanism if required.
- Measures shall be employed to avoid contamination, especially when the meter is installed in a pit, by mounting the water meter and the fittings at a sufficient height above the floor. If necessary, the pit shall be provided with a sump or drain for water removal.
- The meter shall be protected from the risk of damage by shock or vibration, from extremes of temperature, of water or ambient air, and due to external environmental corrosion.
- The meter shall not be subjected to undue stresses caused by pipes and fittings. If necessary, it shall be mounted on a plinth or bracket.
- Unfavorable hydraulic conditions, e.g. cavitation, surging and water hammer, should be avoided.

**General recommendations continued**

- Meters should be installed inside meter casings to reduce the chance of theft and meter tampering. The casings should be lockable and can be made out of concrete or metal.
- Meters should be installed in such a way, that each consumer unit can be billed individually (based on Article 41 1 (d), Constitution of Kenya).

**Steps in installing meters**

For a water meter to register water passing through it accurately the following conditions has to be observed.

- After tapping a connection from a pipeline flush the laid pipes thoroughly before installing up a meter
- Test the meter before installing it
- Install a meter in a way that the flow of water flows in full bore in the meter
- Install meter to the pipeline ensuring that the arrow on the meter body coincides with the direction of water flow
- Meter diameter and the pipe diameter that the meter will be installed should be of the same diameter
- Threaded meters must be installed using their meter liners/ connectors but not direct to a pipe fitting
- Locations which are subjected to severe shocks or hammer should be avoided
- For consumer meter installations, use a stop cock and where gate valve is used incorporate a non-return valve to protect the meter from reversing when rationing or empting the pipeline. This is because all meters are not manufactured with in-build non retune valves
- Where water is not free from debris strainer should be installed upstream of the meter to protect it at all times
- Avoid coupling a meter direct to sluice valve, Provide a straight pipe length equivalent to 10 times the diameter of the meter up and down stream to the meter
- Meter should not operate with a free discharge, there should always be some downstream resistance
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# OPERATING AND MAINTENANCE OF METERS

**Water Meter Management Team**

| Personnel | Role |
|---|---|
| **Supervisors** | Responsible for customizing this Guideline to the WSP-specific context and overseeing the implementation of a meter management strategy. |
| **Meter testing specialists** | A staff member who has been trained in using portable meter testing equipment for in-situ testing of small and large diameter meters. In the case of larger WSPs, this person would implement or coordinate the meter testing/servicing/calibration activities (with a meter test bench) in an established meter workshop. |
| **Meter installation/servicing technicians** | One or more (subject to the number of meters) staff members responsible for new installations, (regular) meter servicing and replacement. |
| **Data analysts** | A staff member who monitors the meter performance trends (i.e. monthly static meters), analyses the attributes of replaced (faulty) meters and refines the meter management (including replacement) strategy in consultation with the supervisor. |

## Meter Testing and Calibration

- The testing & calibration of a water meter is essential before putting it into use as it is a statutory requirement. It is also essential to test it periodically in order to ascertain its performance as during the course of meter working it is likely that its accuracy of measurement may deteriorate beyond acceptable limits.
- A meter suspected to be malfunctioning is also tested for its accuracy of measurement. A faulty meter if found to be repairable, is repaired and tested and calibrated for its accuracy before installation.
- The metering accuracy testing is carried out at Qmin, Qt&Qmax. Separately. Where:
  - ✓ Qmin: Lowest flow rate at which the meter is required to give indication within the maximum permissible error tolerance. It is as mentioned in IS779 and is determined in terms of numerical value of meter designation in case of ISO 4064.
  - ✓ Qt: The flow rate at which the maximum permissible error of the water meter changes in value.
  - ✓ Qn: Half the maximum flow rate Q max.
  - ✓ Qmax: The higher flow rate at which the meter is required to operate in a satisfactory manner for short periods of time without deterioration.

## Repairs Maintenance

**Preventive maintenance:-**

- Proper handling, storage and transportation of water meters.
- To clean the dirt box or strainer wherever installed.
- To replace the gaskets, if any.
- To clean the chamber in which the meter is installed and keep free from flooding, & seepage.
- To remove the meter for further internal repair/replacement if it does not show correct reading pattern.

**Breakdown maintenance:-**

- Disassembling of water meters including strainer, measuring unit, regulator, registering device, etc.
- Clean all disassembled spare parts in detergent solution in warm water.
- Inspect the cleaned parts and replace worn parts and gaskets, if any.
- Inspect the meter body spur threads and cover threads.
- Inspect the sealing surface on meter body and paint the meter body, if necessary.
- Inspect the vane wheel shaft pinion, bearing & pivot.
- Inspect the vane wheel chamber.
- Reassemble the water meter properly after reconditioning.
- Calibrate & test the repaired water meter for leakage & accuracy as per national standards.
- Make entry in the life register of that water meter for keeping history record.

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## Prevention of Tampering With Meters

- The water meters, shall be installed properly in the chamber with lock and key or in the C.I. covers with lock and key in order to avoid tampering.
- The water meters must be sealed properly.
- The water meters shall not allow reversible flow; it should register flow in forward directions only.
- The water meter dials should be easily readable without confusions.
- The lid, glass of water meters must be made up of tough materials as per IS 779 and shall be replaced timely.
- In case of magnetically coupled meters, the proper material to shield magnets must be provided in order to avoid the tampering of such meter by outside magnets in the vicinity of meter.
- Periodical inspection/checking at site is essential to ensure the proper working of meter.
- Special sealing arrangements may be necessary and provided for bulk meters whereby unauthorized removal of the meter from the connection can be detected.
- Inspite of above, to tackle the problems of tampering suitable penalty provisions/clauses shall be there in the rules or the water supply agreement with the consumer. This will also discourage the consumer tendencies of neglecting water meter safety.

## Trend of Meter Replacement

In general, if a water meter goes out of order due to any physical damage or non-operation of registration device and is beyond economical repair it should be replaced with immediate effect. In Kenyan context, the performance of water meter depends upon –

- The quality of water meter produced by manufacturer and it differs from manufacturer to manufacturer.
- The design of pipeline & fittings in line with meter;
- The workmanship & care when handling and installing the meter;
- The pattern of water passing through the meter;
- The type of supply of water whether it is continuous or intermittent;
- The meter maintenance, testing;
- The proper selection of meter.

| S.No. | Trouble | Cause | Remedy |
|---|---|---|---|
| 1. | Meter reads in reverse direction | Might have been installed in reverse direction | Check the arrow on the meter body and install the meter properly, if necessary |
| 2. | Meter not recording | Impeller to register link broken | Remove the meter for servicing and repairs |
| 3. | Continuously moving pointer/digit rotates but no change in indicator | Pointer and drum link missing<br>Drum defect | Remove the meter for servicing and repairs<br>Remove the meter for servicing and repairs |
| 4. | Dial/glass foggy | Climatic condition | Wait for climate change, if it is rainy season |
| 5. | Meter suspected to be slow or fast | Inlet flow disturbance, missing internally defective, deteriorated magnets in case of magnetic meter | Clean the external filter/dirt box where provided and the in-built strainer<br>Ensure full open condition of upstream valve. If doubt persists, remove meter for testing, servicing & repair |
| 6. | Bush/gland leakage | Gland deformity | Remove meter for testing and servicing |
| 7. | Regulator, head, body leakage | Regular washer damaged, loose screw | Remove the meter and repair |
| 8. | Physical damage to meter including broken seal | Improper installation | Remove meter for testing, servicing and repair, physical protection arrangement be made |
| 9. | No water available past the water meter even though inlet side is charged | Semi positive/positive displacement meter with jammed piston | Meter is acting as a stop valve. Remove it for inspection, servicing and repair |

Template for troubleshooting in meters