



Ministry of Water and Environment
Directorate of Water Development
WATER UTILITY REGULATION DEPARTMENT
(WURD)

GUIDELINES

STANDARDIZATION OF MECHANICAL COLD WATERS
(MICRO AND BULK WATER METERS)

FEBRUARY, 2017

PREAMBLE

The Water Utility Regulation Department (WURD) of the Directorate of Water Development is mandated with establishing standards of service in the provision of water supply services across the country. This is against the backdrop of numerous service providers, suppliers of equipment and other inputs and different agencies of Government (Local/ Regional and Central). These variant players have unsurprisingly resulted into uneven service levels to consumers. One key area affected by this development is metering in a bid to introduce commercialization of water services. A Water Meter is one of the salient components in the provision of water supply services. The non-stringent and/or lack of enforcement of acceptable minimum qualities of Water Meters being used in the sector has led to big water losses for utilities with the open market providing a wide range of meters many of which do not meet basic acceptable engineering standards. These water meter guidelines have been developed to ensure consistency and improved efficiency in the provision of water supply services in Uganda's water sector.

APPLICABILITY OF THE GUIDELINES

These Guidelines and Regulations shall be applicable to water meters installed and/or to be installed by all contractors and water service providers engaged in the business of water production, transmission, trading, distribution and supply to all categories of consumers.

The guidelines have been developed in line with the objectives of the National Water Policy which recognizes the fact that water resources are scarce and finite; hence the need to manage them in a way that is efficient and cost effective; and the Water Act, Cap 152 Section 94(3) which requires the assessment of the quantity of water consumed to be registered by a Water Meter.

TYPE OF WATER METERS

1. The type of water meters used shall be of type "Cold Water Mechanical or Smart meter"
2. The meters not complying with these regulations shall be replaced by the service provider on his own or on request of the consumer. The meter replacement may also be replaced on the request of the Director, DWD or his representatives.

OWNERSHIP OF METERS

All system meters installed along the Transmission and Distribution lines shall be controlled and maintained by the service provider but owned by the Directorate of Water Development, Ministry of water and Environment for public water supplies.

LOCATION OF METERS

The Location of water meters in water supply systems shall be as per the table below:

Stage	Meter Type/ size	Location	
At water source	Bulk meter (Size may vary)	- End of suction pipe or riser mains	- Safety of the installed meter shall be responsibility of the service provider
Treatment works	Bulk meter (Size may vary)	- Inlet of treatment works - Outlet of clear water tank	
Reservoir/ storage tank	Bulk meter (Size may vary)	- Inlet of Reservoir - Outlet of Reservoir	
District Metering Area and Sub-District Metering Area	Bulk meter (Size may vary)	- Inlet into supply zone	
Consumer point – Large consumers	Bulk meter (Size may vary)	- Inlet into premises	
Consumer point – Smaller consumers	Micro meter (Size may vary)	- Inlet into premises	

ACCURACY CLASS OF METERS

Every meter shall meet the requirement of accuracy class as specified in the Technical Specifications given in the **second Schedule**.

The service provider shall be required to keep a “Check Meter” that is calibrated. This will be used as a first basic test for defective meters.

INSTALLATION OF METERS

1. The service provider, as the case may be, shall have the right to examine, test and control all meters before installation and only correct meters shall be installed.
2. The meter shall be installed at locations, which are easily accessible for installation, testing, commissioning, reading, recording and maintenance. The place of installation of the meter shall be such that minimum inconvenience and disruptions are caused to the site owners and the concerned organizations.
3. The installation of consumer water meters shall follow the procedure outlined in Part 2 of these guidelines.

REGULATION OF WATER METERS

The Director, Directorate of Water Development (or his representatives) shall have the sole right to regulate the Water Meters used by service providers in the water sector. He shall also have the right to amend these standards of service as and when the need shall arise.

PART 1

GENERAL REQUIREMENTS FOR MECHANICAL WATER METERS (COLD)

1. Water meters are mandatory for all Water production sources, Reservoirs, residential structures and larger commercial buildings or institutions
2. The designated operator shall determine the appropriate meter size to be installed for the different categories of consumption.
3. Meters shall be installed in accordance with best plumbing practices and:
 - a) In an area dedicated specifically for the meter, valves and check valves assemblies, all other plumbing apparatus shall be installed after the last valve on the downstream side of meter.
 - b) In a horizontal position and located before any branched services.
 - c) In a dry and easily accessible open area not concealed or obstructed.
 - d) With the minimum clearance on all sides and above the floor as shown in the attached Meter Assembly details.
 - e) Shall not exceed a height of forty-two (42) inches without an approved platform.
4. Meters shall not be installed belowground in a pit or pit environment.
5. Volumetric type mechanical water meters used mainly for domestic metering deteriorates over time. The recommended requirement for the replacement of mechanical domestic meters shall not exceed 10 years.
6. The type of meters installed shall be cold water meters
7. The Class of the meter indicate the accuracy of the water meter in measuring low flow rates. ***A minimum of Class B shall be used in provision of water supply services.***
8. The type of meter must be selected based on site conditions, but in all cases dry dial meters should be used in applications where the water quality is suspect, i.e. Contaminated.
9. The meter shall have a clear identification of all basic technical parameters as stipulated in the attached schedule detailing the requisite meter specifications.
10. It should be clearly determined whether a meter is a vertical/inclined meter or horizontal. The installation shall be carried out as such.

PART 2

Installation Instructions for non-flange type meters:

1. Thoroughly flush the service line upstream of the meter to remove dirt and debris.
2. Remove meter thread protectors. NOTE: To protect the meter spud threads, store the meter with thread protectors in place
3. Set the meter in the line. Install the meter in a horizontal plane, with the register upright, in a location accessible for reading, service and inspection. Arrows on the side of the meter and above the outlet spud indicate the direction of flow.
4. Do not over tighten connections; tighten only as required to seal.
5. Do not use pipe sealant or Teflon tape on meter threads.
6. If meter is equipped with an electrical contacting head register, line up molded tabs on inside of reed switch with corresponding indentation's of receptacle on face of the meter. Insert reed switch and turn $\frac{1}{4}$ turn to lock in place.
7. Tie black and red wires on opposite end of reed switch to corresponding black and red water meter wires on controller. Insulate connection with water-proof wrapping.

Installation Instructions for flange type meters:

1. Thoroughly flush the service line upstream of the meter to remove dirt and debris.
2. If necessary thoroughly clean the flange faces by brushing with a wire brush.
3. Insert the bolts with their heads on the meter side. i.e. With their threads pointing outwards.
4. Place the flange gasket between the bolts and offer up the opposite flange carefully so that the gasket is central.
5. Holding the bolt heads, fit each nut, beginning with the top most, only tightening by hand, ensuring that the flange gasket is captured in its correct position.
6. When all nuts have been hand tightened and a final check is done to ensure that the flange gasket is correctly placed, proceed to tighten further using the correctly sized spanners, preferable ring, one on the bolt head and the other for the nut.
7. Once the tightening of the top stream flanges have been completed, repeat the above for the downstream flange.

FIRST SCHEDULE

Definitions of water meter flow characteristics:

- **Nominal Flow Rate: Q_n**

This designates the flow rate of the meter.

- **Maximum Flow Rate: Q_{max} .**

This value designates the MAXIMUM flow rate at which the meter accuracy will be within the maximum permitted error.

- **Minimum Flow Rate: Q_{min} .**

This designates the LOWEST flow rate at which the meter accuracy will be within the MAXIMUM permitted error.

- **Transitional Flow Rate: Q_t .**

This designates the flow rate at which is the MAXIMUM permitted error of the meter changes.

- **Maximum Permitted Error: $\pm 5\%$**

This is the MAXIMUM error allowance between Q_{min} to Q_t .

- **Maximum Permitted Error: $\pm 2\%$**

This is the MAXIMUM error allowance between Q_t to Q_{max}

Note: The Class does not indicate the accuracy of the water meter but rather at what flow rate the water meter meets the common accuracy figures. These are $\pm 5\%$ at the minimum flow rate and $\pm 2\%$ in the meters normal range (between Q_t and Q_{max}) for cold water meters.

SECOND SCHEDULE

TECHNICAL SPECIFICATIONS AND FUNCTIONAL REQUIREMENTS OF WATER METERS

1.0. WATER METERS

The meter specifications outlined below are to be followed in procurement and installation of mechanical cold water meters in the water sector in Uganda. The water meter shall be able to work with relatively high accuracy at relatively high flow rates in water that often receives suspended particles/solids accidentally generated during operation and maintenance of the distribution network.

1.1. General Requirements – Meter Type

- (a) The meters shall be horizontal type cold water meters of dimensions 100mm, 150mm, and 200mm nominal diameter, able to handle relatively loaded water (with solids) without blockage. They are to be offered under the terms of the Tender and Specifications and must be fitted with sealed extra-dry dial metric counters and pre-equipped for communication. The meter should be fitted with a low mass rotor which is parallel to the direction of water flow and exhibits dynamic thrust relief.

1.2. Applicable Standards:

1.2.1 The meter shall conform to:

- (i) Prescriptions of the regulation No 49 of the O.I.M.L R49:2000 (International Organisation of Legal Metrology)
- (ii) The water meters shall have EC type approvals, and bidders shall be required to quote only approved values. The valid approval certificate must be attached to the bid.
- (iii) *ISO 4064/1:1993 standard

1.2.2 Manufacturer

- (i) The Manufacturer of the water meters must hold the Quality System Certificate for the standard ISO 9001:2000. A copy of the certificate must be attached to the bid.

1.2.3 *Approbation Certificates

Copies of the relevant approbation Certificates and Approvals are to be provided by the Bidder.

1.3. Material and Workmanship

All materials used in the manufacture and assembly of meters shall be suitable for use in Uganda's climatic conditions (Tropical). The meters shall be guaranteed against defects in materials and workmanship for a minimum period of one year from date of delivery. Parts to replace those in which a defect may develop within such period shall be supplied without charge, piece for piece, upon the return of such defective parts to the supplier thereof or upon proof of such defects.

Meters should be designed for easy disassembly and re-assembly without the use of special tools or equipment and should be easy to maintain and repair. Meters designed to resist vandalism will be preferred. All parts of the meters shall be finished to ensure interchangeability, which is to be guaranteed. All products should be manufactured to ISO 9001 standard.

The materials for the parts of the meter shall be as follows:

(a) Main Casings:

The meter body shall be manufactured of appropriate material for Tropical conditions (such as cast iron or copper alloy) and shall be resistant to external and internal abrasion/corrosion, able to withstand the corrosive effect of residual chlorine in water, and of adequate strength to resist damage due to shock and or vibration. The meter body/casing shall be resistant to severe conditions while in service.

The technology must be such that no parts of the register are in contact with the water passing through the meter. The water meter and accessories shall be manufactured from materials of adequate strength and durability. The materials which come in contact with portable water, shall not create hazard, shall not support microbial growth, and shall not give rise to unpleasant taste or discoloration in the water supply.

(b) Internal Strainers

A full range of strainers will be available in sizes compatible with the meters and will have the same general specification as the water meter.

The meter shall be supplied with a cleanable tabular remover integral strainer in the inlet of the water meter 12holes/cm²

(c) Connections

The meter shall be supplied complete with a set of connectors that are made of copper alloy resistant to corrosion, to rust and to damage due to or vibration. The connectors shall comprise of cap nuts, linings and fibre sealing washers. Where applicable, the meters will be supplied complete with connecting gaskets and bolts to provide a working seal between the meter and the adjoining pipe work. The meter linings shall have provisions of safe guard against tempering. Meter linings shall have provisions for fixing a sealing wire so that dismantling of the meter parts will not be possible without breaking the sealing wires.

(d) Non-Return Valve

The meter shall be supplied with a device of non-return flow restrictor to avoid reversing flow. The restrictor shall be in built such that removing it would require dismantling the meter body. The restrictor should exact minimum resistance to water flow in positive/forward direction.

(e) Assembly:

* Meter shall be designed with an opening provision being made for maintenance purposes, while catering for tamper resistance. The meter assembly shall be easy to maintain and repair, resistant to vandalism and have multi-modal mounting facilities i.e. either horizontal or vertical for usage. The supplier shall outline his proposal to achieve this. Any required special tools required to dismantle and re-assemble the meter shall be provided.

(f) External calibration

Where the meter has an external calibration device, the external screw for calibration shall be protected by a special plug or wire sealing. The external calibration adjusting screw used during the manufacturing stage shall be in such a way as to prevent manipulation without breaking the calibration seals once it has been installed

1.4. Marking

Each meter shall be permanently marked on the casing or the indicating device dial with the following information:

- (a) The nominal size of the meter
- (b) Direction (arrow) of flow of water on both sides of the meter
- (c) Normal flow rate (Q_n)
- (d) Maximum flow rate (Q_{max})
- (e) A Serial number
- (f) country of origin,
- (g) Manufacturer's name and commercial model name
- (h) Metrological class
- (i) The nominal working pressure (PN) in bars
- (j) The volume unit of the index (m^3)
- (k) Meters should have effective temper- proof seals with proven experience of performance in similar working environment.

1.5. Size and Length

The overall length of meter between connector/flange faces shall be in accordance with ISO standards.

1.6. Testing

- (a) *Each meter shall be tested for three mandatory tests of Q_{min} , Q_t , Q_n and Q_{max} in accordance with ISO 4064-1:1993.
- (b) *Copies of the calibration test results/certificates shall be availed together with the sample water meters (for all the above metrological points).
- (c) All Meters shall be pressure tested and a batch certificate attesting of such tests availed by the water meter manufacturer. The certificate shall indicate the test pressure of 25 Bars for a period of 15 minutes and 32 bars over a period of 1 minute.

1.7. Measuring chamber and Element

The measuring chamber housing and measurement element should be made of materials that are tough, non- hydrolyzing and that ensure durable wear. The chamber design shall optimize water flow and eliminate harsh turbulence for smooth operation that minimizes bearing wear. The measuring surface shall provide sustained accuracy despite the presence of particulate and solids matter in the water. A durable synthetic sapphire bearing will serve as wearing surface. The chamber housing shall be constructed in two parts to allow access to the impeller.

1.8. *Registers*

The Register (counter) shall be direct straight reading in cubic meters and tens of litres as indicated in Table 1. Meters should have number wheels easy to read, calibrated at and of SI standards (preferably big and bold in size) and not vulnerable for manipulation by external interference. The register shall be protected by a resistant lid.

The register has to be extra-dry, copper can/mineral glass hermetically sealed envelope to be fully protected against condensation.

The register must be *IP68 and:

- a) Shall be of straight reading type
- b) The register shall register in cubic meter units
- c) The register shall consist of a row of minimum number of on-line consecutive digits as shown in Table 1
- d) Another two digits or pointers shall register flows in liters and be of a different colour the smallest reading shall be tens of litres
- e) The register or any part of it shall be capable of being repaired
- f) The register should be of open type and interchangeable with a pre-calibrated mechanism. Changing the mechanism should not have an effect larger than $\pm 0.5\%$ on the accuracy of the complete meter within the EEC limits for the Class B standard.
- g) Shall be able to work permanently in flooded environments up to a depth of more than 1m
- h) The pre-equipment and the proposed communication equipment must be insensitive to magnets of 2500 gauss. The remote reading feature must be able to be added without taking the meter from the pipe or dismantling the meter
- i) The choice of the pulse value must be independent from the pre-equipment.
- j) The pre-equipment should allow the delivery of a wide range of pulse values: minimum 5 different pulses values.
- k) The pre-equipment should allow upgrading the meter with a remote reading device absolutely trustable in the long term (the register and the remote indicator must always indicate the same amount of forward volume, hence backflow must not be computing as forward volume).
- l) The proposed compatible communication equipment must be able to be installed on site without breaking any metrological seal.
- m) The magnetic transmission interface between the measurement chamber and the register must be tamper-proof. The meter must incorporate protection from external magnetic influences (fraud) i.e. the blocking of the gear train by means of an external magnetic field.
- n) **Extra dry and hermetically sealed in order to avoid condensation.** The glass must be made of mineral glass and have a thickness of at least 5mm. The register unit must be sealed in either a copper or brass can. The register shall remain condensation free when submerged to 1m depth of water.

1.9. *Impeller and impeller chamber*

The impeller/turbine assembly shall be symmetrically aligned/pivoted, with wide clearances to allow for sand and other impurities to pass through the meter without affecting its performance. The materials for the impeller/turbine assembly must be resistant to corrosion.

1.10. Metrology:

The meter shall maintain its Class B performance in any position and proven by an EEC approval or equivalent. Bidders shall be required to indicate the Q_n , Q_t , Q_{min} , Q_{max} and Q_s for the meters offered.

1.11. Installation

The meters supplied must be capable of functioning effectively when installed horizontally or in an inclined position. In addition they should perform well in both wet and /or dry chambers.

1.12. Head loss:

Meters shall show a loss of head not exceeding 0.1 bar at Q_{max} in accordance with ISO 4064 or BS5728 Part7.

Working Pressure and Temperature Requirements:

2. The meter working pressure shall be 16 Bars, and a test pressure of 25 Bars. They should also be able to withstand a normal working temperature of up to 30 degrees centigrade and maximum temperature of 50 degrees centigrade. Bidders shall be required to state the following pressure and temperature requirements for the meters to be supplied: Nominal pressure (PN), pressure loss at Q_{max} (bars), test pressure-static in bars, working temperature and maximum temperature in degrees centigrade.

2.0. SEALS

All meters shall be sealed with approved type of seals and seal wires. The Supplier shall provide the seals and seal wires.

3.0 SPARE PARTS AND COMPONENTS

The supplier should guarantee meters spares for a period of 10 years after meter manufacture.

4.0 OTHER REQUIREMENTS

4.1 Warranty

* The warranty period shall be a minimum of 2 years and the metrological meter performance within 2 years should not vary much from the original Q_{min} , Q_t and Q_{max} .

4.2 Notes

4.3 Branding: The meter shall be branded "Property of Ministry of Water and Environment".

4.3.1 Technical notes:

- a. The models offered must be of current production models with proven performance and operation record in conditions similar to Uganda's climate.
- b. A letter of Authorization (not photocopy) from the Manufacturers if the bidder is not a manufacturer must be included in the proposal.
- c. At least one original Brochure (Not Photocopy), Technical Data and an illustrated blown out drawing of the meter components and parts must be included in the proposal. Proposals without this information will be considered non-responsive.

4.3.2 Other Notes

- a) Standard International (SI) units must be used in preparing the proposals.

N.B (*) Indicates that it is a technical specification which is mandatory and failure to adhere to it will be considered as non-responsive.

TECHNICAL REQUIREMENTS FOR PRE-PAID COLD WATER METERS

Application

For measuring the flow and volume of cold water with a temperature up to 30°C or 50°C in the closed-circuit system with the full flow of the flux, and on the maximum working pressure up to 16 bar (PN16). Recommended installation of a prepaid water meter-set concerns metering of water consumption in rented flats, social flats or in holiday cottages i.e. everywhere where the consumer changes very often and there might be a problem to collect the amounts due for water consumption. Suitable for installation in the horizontal hoses (pipelines) with the counter directed upwards (H) and in vertical or horizontal hoses with the counter directed sideways (V). Prepaid water meter system consists of: prepaid water meter set (IP68 – JS water meter, stop valve, electronic module), wireless control unit and PC software. The system is intended for settlement of water consumption based on in advance payments for 6-digit codes that allow drawing a definite water volume. When the water volume bought will be used up, the water flow is closed by the valve. The outlet port of stop valve housing is adapted for optional installation of a return valve.

Metrological class (MID):

- Cold water R160; 100; - H; R63; 50 - V

Product features

- Unique prepaid codes
- Possibility to buy codes via Internet or mobile phones
- If the volume of water bought will be used up, further drawing of strictly defined water volume is possible after activation of overdraft function
- Full control over water expenses
- Elimination of the costs of meter reader's services and monitoring of the amounts due
- Minimum battery life 6 years – 700 operations of valve opening/closing
- Alarm in case when credit for the use of the water volume that was bought is soon to be used up or if battery level is low

Basic technical data

Type		Q ₃ [m ³ /h]	DN [mm]	Length [mm]	Connection
JS 2,5	R160	2,5	15	165	G¾
JS 4,0	R160	4,0	20	190	G1

Technical Requirements for the Dispenser

Hydraulic Capacity	1m ³ /hr (under normal working conditions)
Tapping Increments	1 litre
Dimensions of inlet and outlet pipe connections	½" external thread
Weight (kgs)	23kg
Dimensions	400 500 x 210mm
Protection Class	IP 45
Capacity of included back up battery	18 Ah = approx.. 12hrs of operation
Battery extensibility	External battery can be connected
Reading angles of display	-/+ 60 degree
User interface	Touch and sound
Direct flow sensor	<ul style="list-style-type: none"> No metering of air pockets. No mechanical wear parts.

Installation Requirements

Power Supply	<ul style="list-style-type: none"> Grid power AC connection, 110 -240V, 50/60Hz. Solar panel DC voltage 15-45V/3A
Max. Power Consumption	45W (1 solar panel is enough)
Ambient temperature	1 -50°C.
Max. relative humidity	95%
Water quality	WHO drinking water quality
Water particle content	<ul style="list-style-type: none"> Particle size max. 0.5mm Install with supplied strainer
Water temperature	0.1 – 40°C.
Inlet pressure range	0.2 – 4 bar (height of main tank outlet >3m)
Mounting	Designed for wall-mounting, protected from direct sunlight.

Water Management System (WMS) and Connectivity

Broadcasting alarms/warnings	of	Set up in water management system
Data upload		Min. every 24 hours
Data import from unconnected dispensers		Via associated PC tool
Smart card connectivity		NFC
Dispenser connectivity		GSM Quad-band and GPRS connectivity
Connectivity set up		<ol style="list-style-type: none"> 1. Install sim card in dispenser. 2. Enter associated phone number, IMEI number, and select telecommunication operating water management system. <p>The unit is functional without connectivity</p>
Connectivity extensibility		External antenna can be connected.

Water management system
browser support

- Explorer: version 9 or newer
- Firefox: Version 10 or newer
- Chrome: version 17 or newer.
- Safari: version 6 or newer
- Opera: version 10 or newer.

DRAFT