

**ANNEX C**  
**ELECTROMAGNETIC FLOWMETER WITH GPRS**

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I. Specifications

General Specification

- The flowmeter shall measure water flow, totalized volume and pressure in a close conduit pipe in metric system of measurement (liters/hour, m<sup>3</sup>/hour, liters, m<sup>3</sup>)
- The flowmeter shall measure water flow bi-directionally.
- The flowmeter shall be a battery-powered electromagnetic flowmeter that will measure and monitor the water flowing through the meter and pressure continuously.
- The flowmeter shall have internal data loggers which shall log the flow and pressure data continually and shall transmit the data via General Packet Radio Services (GPRS) communication periodically directly to file servers including a file server of MCWD where the data are stored, viewed, analyzed and printed. The supply, delivery, installation and maintenance of such equipment shall be shouldered by the JV partner.
- The JV partner shall also provide the needed software, software configuration and the maintenance fees for the transmission of the data to the MCWD server where MCWD shall have access to production data and pressure profile 24 hours a day, seven days a week.
- The JV partner shall provide training to MCWD personnel on the use of the Automatic Meter Reading (AMR) software. Cost of such training shall be borne by the JV partner.

II. Flowmeter

- The flowmeter size shall be 250mm (10") nominal diameter.
- Maximum rated capacity  $\geq 800$  m<sup>3</sup> per hour with an allowable error =  $\pm 2\%$
- Transitional flow rate  $\leq 6$  m<sup>3</sup> per hour with an allowable error =  $\pm 2\%$
- Minimum rated capacity  $\leq 2.4$  m<sup>3</sup> per hour with an allowable error =  $\pm 5\%$
- The flowmeter shall be a full bore type design.

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- The flowmeter shall be of an electromagnetic induction type with no mechanical moving parts.
- The flowmeter shall fully operate on an internal battery without need of any external power source.
- The flowmeter power shall be supplied by an internal battery which shall last to at least three (3) years. It shall have at least two (2) batteries which shall automatically switch over whenever one battery loses power. A time of at least one and a half (1<sup>1/2</sup>) years shall be given to replace the dead battery before the second battery also loses power. The internal battery shall be available in the market and shall be easily replaceable on-site.
- The flowmeter shall be made secure and compact with no external cabling or junction box that can be easily tampered with and immune to magnetic tampering.
- The flowmeter shall be flange type with flange sizes and holes according to I.S.O. standards with pressure ratings up to not less than 1,600 Kpa.
- The flowmeter should be provided with proper grounding system

Sensor

- The flowmeter sensor shall be fully welded design to minimize risk of water ingress. The flow sensor shall be rated to IP 68 ingress protection and shall not have any electronic components within the sensor body.
- The flow sensor material shall be made of carbon steel with corrosion resistant two-component epoxy coating. Corrosivity category C4 according to ISO12944-2.
- The lining of the sensor in contact with water shall be made from suitable materials for potable water and can withstand pressures up to 1,600 Kpa/232 psi and liquid temperatures of up to at least 60°C.
- The flowmeter sensor shall be of compact type and directly coupled to the flowmeter converter forming one unit.
- Straight length pipe requirement of the meter shall be  $\leq 5$  times the length of the nominal size of the flowmeter.

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Converter

- The flowmeter converter shall be of a compact type with no external wirings and shall be rated to at least IP 67 for ingress protection.
- The flowmeter converter shall come with an internal data logger to log flow rate, both positive and negative, and pressure continually. Logged data shall show date and time references.
- Sampling interval for flow and pressure shall be user settable from 1 to 15 seconds. Data logging interval shall also be user settable between one to thirty minutes.
- The pressure transducer where a hose can be fitted to take samples of pressure in the pipeline. The pressure measurements shall also be logged into the internal data logger of the meter. Pressure range shall be between 0 to 200 Kpa.
- The flowmeter converter shall also come with a Liquid Crystal Display (LCD) display which shall display flow rate, totalized volume, battery levels, flow direction, positive totalized volume, negative totalized volume, net volume etc. All flow measurements and totalized volume shall have the corresponding units to avoid confusion.
- The flowmeter converter shall come with an integrated keypad where meter settings can be keyed in. Protection codes shall also be available so that only authorized personnel can change the settings of the meter.
- The battery level status of the meter shall also be monitored and transmitted to the data servers including that of MCWD. If a low battery level occurs an alarm shall be sent to data servers including that of MCWD in order that the operator can replace the battery in the presence of MCWD personnel.
- The converter shall also come with a protection enclosure which can be locked using 2 different pad locks together. This box shall be so designed that no manipulation of the meter converter can be done without opening the two pad locks. This enclosure shall be suitable for outdoor installation and shall not disrupt any communications with the file server and other devices.
- The converter must be so designed that the meter's calibration, accuracy, readings, and date-time signatures cannot be altered without MCWD knowing such changes. An alarm system shall be sent to MCWD file server if such changes are made.

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Communication

- The flowmeter shall come with an internal GSM/GPRS modem for data transmission via GPRS communication directly to file servers including a file server of MCWD where the data are stored, viewed, analyzed and printed. This data shall have time signatures. The data transmission shall be settable from 1 to 24 hours.
- The data sent to file servers (including MCWD file server) shall include data from the flowmeter data loggers and shall display flow, totalized volume, pressure, battery levels and other alarms, with time and date signatures.
- The data system shall come with an automatic data acquisition module that shall be responsible for all communications functions of the flowmeter. The data acquisition module shall automatically retrieve data to and from the flowmeter.
- A calculation module shall be provided to automatically calculate relevant data on an hourly, daily, weekly and monthly basis and shall show graphs of data.
- An alarm shall automatically be sent to the MCWD file server in the event that changes in meter settings are being done.

III. Other Requirements

A. Technical Manual and Brochures

- Technical brochure shall be provided and demo software shall be provided for evaluation.
- Operating manuals and maintenance manuals shall also be provided upon delivery of equipment.

B. Testing of Water Meter

- MCWD shall test the water meter together with the meter provider for accuracy and functionality.
- In the event that the meter fails the test, the JV partner shall replace such meter with one that will comply with all the specification and requirements in this document.

C. Installation & Commissioning of Water Meter

- MCWD reserves the right to supervise check the meter installation and shall approve or reject in accordance to the requirements of this specification.

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D. Training

- Training of at least 4 MCWD personnel must be conducted by the JV partner for the proper operation and maintenance of the equipment and the use of the automatic data acquisition system software.