

**DELHI JAL BOARD: GOVT OF NCT OF DELHI
OFFICE OF THE MEMBER(W.S)
VARUNALAYA PH-II, KAROL BAGH, NEW DELHI**

No.F/5/DJB/Member(WS)/2014/ 2487

Dated. 8/1/2015

CIRCULAR

Sub: Specifications for Bulk Flow & Pressure measuring system for Water Auditing

The Bulk Flow Meters are being used in DJB for measuring flow in transmission mains and distribution mains. The flow data is accessed remotely through a unit called RTU attached with the flow meters. These meters are installed at different field locations along the pipe lines. Considering constraints and limitations of providing electric connections at the field locations, it has been considered to use battery operated bulk flow meters for this purpose. Further, measurement of water pressure along with flow is also considered as the pressure and flow data can effectively be used for modeling the pipe network and assessment of water loss, bursts etc. Accordingly, the specifications of battery operated bulk flow meters and pressure sensors are attached herewith. All concerned are directed to use these specifications for procurement of bulk flow meters & pressure sensors to be installed for carrying out water audit of transmission mains of various WTPs.

S/L
(R.S. Tyagi)
Member(WS)

All Chief Engineers/ DOR

Copy to:

1. CEO
2. Member(A)/Member(F)/Member(Dr)/CVO
3. Secretary, DJB/ Director(A&P)/Director(F&A)
4. All SEs/Jt. Directors(R)
5. All EEs/ All ZROs/ Consultant(PR)
6. EE(EDP) - with a request to upload on DJB's website
7. office copy

7/1/15
Member(WS)



AET

Programmer I

MSL

SPECIFICATIONS

1.1 Bulk Flow measuring systems for Water Auditing

1.1.1 Introduction

The flow measurement system for bulk flow measurement shall be electromagnetic type meters with GPRS. Each water meter intended is for a potable water supply. It shall comprise two principal components, as follows:

- A flow sensor of the electromagnetic type, which shall be suitable for installation in a buried water main. The sensor shall be connected to the main by means of PN 16 flanged connections. The meter shall be suitable for installation in a flooded chamber and for being directly buried.
- An electronic display unit. This shall be installed in an above ground cabinet enclosure in a convenient location as close as possible to the water meter..

The water meter shall be powered by batteries which shall be integral to the electronic display unit. The batteries shall be capable of being replaced by the Employer's staff at site and capable of providing uninterrupted power supply at the specified voltage for not less than 3 years duration without battery replacement. The Contractor shall replace at no cost any batteries that fail or require routine replacement throughout the contract period.

On a minimum, water meter shall be provided with the following facilities at the electronic display unit:

- Integral real-time clock for date and time recording of flow data.
- Integral data logger for storing data for a minimum of 31 days.
- Serial or suitable communication port to enable data to be passed from the display unit to display flow and pressure details.
- A second serial or suitable communication port for the temporary connection of a laptop computer.
- Input /output block for connecting GPRS transmitter for the transfer of all display/error codes and status functions from the electronic display unit to the DJB central Monitoring system, to be executed by the contractor.

PSION and Laptop, leads and appropriate software and software licences shall be provided to facilitate configuration of the water meters and for down-loading the integral data logger for data analysis.

1.1.2 General Specifications

- a) Full bore electromagnetic flow meter shall consist of flow sensor (i.e. flow tube), flow transmitter and flow indicator and integrator and any other item required to complete the system. To avoid the effects of disturbances in the velocity profile, a straight and uninterrupted run, upstream as well as downstream from the location of the flow meter shall be provided, as required by the flow meter manufacturer and in line with the applicable

standards. Contractor shall finalize the exact location of flow meter in consultation with Engineer.

- b) Flow measurement shall not be affected by physical properties of water viz., temperature, pressure etc., within given limits. Contractor shall provide compensating electronic circuits, if required.
- c) A lockable enclosure shall be provided for the flow transmitter cum computing unit.
- d) Flow meters shall be suitable for the water turbidity at site during various seasons. Flow tube shall be rugged in construction and shall be suitable for continuous operation. Flow tube shall have waterproof construction and shall be suitable for installation on underground / above ground pipe lines.
- e) The flow computer and transmitter shall be a single unit suitable for field mounting. It shall accept inputs from flow tube process the signals and shall provide an output proportional to the flow rate. The output shall be 4-20 MA.

a) General:		
1.	Accuracy of flow measurement during FAT	$\pm 0.4\%$ of measured value
2.	Overall accuracy of flow measurement loop.	$\pm 1.0\%$ of measured value
b)		
(i)	Application	: Water applications
(ii)	Type	: In line fill bore electromagnetic
(iii)	Size of flow tube	: To suit mains flow parameters, with pipe reducers provided as necessary
(iv)	Process connection	: Flanged
(v)	Weather Protection Class	: IP 68 as per IS 13947
(vi)	Material of Construction :	
	Electrodes	: Hastelloy C276/SS
	Coil Housing	: Non corrosive
	Flanges	: Carbon steel
	Grounding ring	: Hastelloy C276/SS
(vii)	Flow tube Lining	: EPDM
c) Flow Transmitter Unit		
(i)	Type	: Microprocessor based with facility to configure the ranges
(ii)	Type of display	: 4 digit backlit LCD/LCD for flow rate in m ³ /hr : 8 digit backlit LCD/LCD for totalized flow in ML • Display with 8 digits for main information. Index, menu and status symbols for dedicated information • Key for toggling through the information and reset customer totalizer and call-up function • Selectable default information and accessible menus: - Operator - Meter - Service - Data Logger

(iii)	Units of display	: Volume: m3 x 100, 1 x 100, G x 100, G x 1000, MG, CF x 1000, AF, AL, KL • Flow: m3/min, m3/d, 1/s, 1/min, GPS, GPH, GPD, MGD, CFS, CFM, CFH
(iv)	Input	: From flow tube
(v)	Output	: 4-20 mA DC (isolated) proportional to flow rate
(vi)	Power Supply	: In built lithium batteries, batteries shall work on a minimum for 3 years without external AC/DC power supply
(vii)	Zero and Span Adjustment	: Factory set Password protection of all parameters and hardware protection of calibration and revenue parameters.
(viii)	Weather Protection Class	: IP 65 as per IS 13947, IP 67
(ix)	Battery backup for totalized flow as a part of power supply Type Capacity Backup Time Data Protection:	Online 2.5 Mva 8 hours Data protection • All data stored shall be stored in an EEPROM. Totalizers shall be backed up every 10 min, statistic every hour and power consumption and temperature Measurement every 4 hour. Minimum 31 days of data shall be stored in EEPROM. • Password protection of all parameters and hardware protection of calibration and revenue parameters.
(x)	Facility for on line diagnosis	: Required as flowing: Diagnostic • Continuous self test shall include - Coil current to drive the magnetic field - Signal input circuit - Data calculation, handling and storing • Features - Alarm statistics and logging for fault analyzing - Electrode impedance to check actual media contact - Flow simulation to check pulse and communication signal chain for correct scaling - Number of sensor measurements (excitations) - Transmitter temperature (battery capacity calculation) - Low impedance alarm for change in media - Flow alarm when defined high flow exceeds - Verification mode for fast measure performance check - Statistic flow and consumption data

1.1.3 The Flow Sensor

The sensor shall be suitable for being directly buried and shall have a degree of protection to IP 68 (NEMA6). The sensor shall have PN 16 flanged end connections.

The sensor shall be suitable for an operating pressure of 16 bar gauge and a system test pressure of 25 bar gauge.

The metering tube shall be suitably lined to withstand abrasion of the fluid. The lining shall be EPDM and shall have been type-tested in an accredited laboratory and have been shown to be suitable for use in contact with potable water (UKWFBS listed).

The electrodes for sensing the voltage induced in the liquid shall be made of type Hastalloy C267/SS.

The coil housing shall be fabricated from corrosion resistant material capable of submerged or buried operation.

The sensor shall be supplied complete with a factory-fitted umbilical cable for communication with the electronic display unit. The cable length shall be determined by the contractor for each meter location, but shall be not less than 20 meters long so that it can be cut on sit to suit the selected location for the electronic display unit. The construction of the signal connectors and cable shall protect the water meter from electromagnetic interference and shall be suitable for buried use and outdoor installation. The cable shall be protected by a suitable robust polyethylene sleeve to prevent accidental damage.

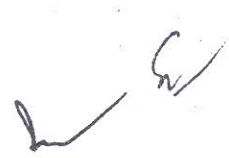
The contractor shall provide all sundry items such as grounding electrodes and/or grounding rings necessary for satisfactory operation of the sensor.

1.1.4 The Electronic Display Unit

The unit shall have LCD displays to show the following parameters, as selected by the operator:

- Cumulative forward flow
- Cumulative reverse flow
- Cumulative net flow
- Instantaneous flow rate
- Instantaneous velocity
- Minimum night flow
- Peak day flow
- Pressure
- Date and time

The user shall be able to configure the electronic display unit to display:

- Cumulative flow in m^3
 - Flow rate in m^3/h or l/s
- 

- Velocity in m/s
- Pressure in m or kg/cm²

There shall also be status indicators for each of the following conditions:

- Battery low
- Fault
- Empty pipe

Calibration:

The electromagnetic flow meter shall be calibrated for the full flow range specified as per BS EN 29104 (Methods of evaluation of electromagnetic flow meters). The calibration method shall be either gravimetric method as per ISO 4185 (Measurement of fluid flow in closed conduits – weighing method).

The 'test bed' shall be accredited by national / international certifying authority. The Contractor shall produce accreditation certificates for the test facility and calibration certificate for each flow meter, for the review by Engineer. The Contractor shall also demonstrate complete calibration on the test bed in the flow meter laboratory. The flow meter shall be acceptable if the accuracy and repeatability is equal to or better than those specified.

1.1.5 Water Meter Operation & Performance

The accuracy, linearity and repeatability of each water meter shall be in accordance with the latest version of ISO 4064 Class C or better, and shall be maintained for an ambient and liquid temperature range of 0°C to 50°C.

In addition, the water meter shall confirm to the below standards

- CEN EN 14154
- PED: 97/23EC
- EMC: EN 61000-6-3,
EN 61000-6-2, EN 61326-1

1.1.6 Pressure Measuring System

(a) Pressure Transmitters (sensors)

Each pressure sensor shall be capable of operating in the range required, and be of the diaphragm type. It shall be provided complete with non-ferrous pipe-work, isolation valves, calibration valves and a surge damper device. Local and remote display units shall be provided. Pressure transmitters shall be designed for operation over 130% of full range. They shall be capable of withstanding surge pressures likely to occur in the monitored system.

(b) General Specifications

- | | |
|----------------------------------|--|
| (i) Service | : Pipeline, adjacent to electro-magnetic meter |
| (II) Quantity & Ranges | : As per process requirements. |
| (iii) Accuracy of measuring loop | : $\pm 0.25\%$ of reading or better |

(b) Pressure Sensor/ Transmitter

- (i) Sensor : Diaphragm Sensor
- (ii) Material : SS 316
- (iii) Range : Adjustable over full span
- (iv) Zero and span adjust : Required
- (v) Output signal : 4-20mA, DC
- (vi) Enclosure Protection : IP 68 of IS 13947 (part-I)
- (vii) Accessories : Isolation valves,
Impulse tubing and all installation hardware
- (viii) Local LCD display : Required
- (ix) Dampening circuit : Required

1.1.7 Vendor list for bulk flow measuring & pressure sensing system.

Sl.No.	Description	Vendor/Manufacture / Make
1	Flow measuring system (Water meter)	M/s ABB M/s Siemens M/s Forbes Marshall M/s Endress+ Hauser
2	Pressure Transmitters / Sensing elements	M/s Emerson M/s ABB M/s Kobold M/s Waaree M/s Siemens M/s Endress+Hauser

Wherever a water meter is to be installed in a water main with cathodic protection, insulating flanges shall be provided on both sides of the sensor and insulated copper straps shall be installed to provide electrical continuity between the pipes on each side of the sensor.

The electronic display unit shall be installed on a removable backboard in a vandal-resistant weatherproof IP65 floor, wall or post mounting cabinet enclosure. The enclosure shall be constructed from galvanised steel which is at least 3 mm thick. The enclosure shall have a hinged access door, which shall have a facility for padlocking in the closed position. Batteries shall be easily accessible for periodic changing. For floor mounting enclosure, the enclosure shall mounted on a concrete plinth, the surface of which shall be at least 150 mm above the surrounding finished ground level. A cable duct shall pass through the plinth to enable the cable from the flow sensor to enter the enclosure. A label showing details of the employer's name and the water meter's unique reference number shall be fixed to the external face of the access door. Contractors or equipment manufacturers details shall be fixed to the external face of the access door.

The enclosure shall be well-ventilated, dust-proof and vermin-proof, and be suitable for robust use in a tropical climate. It shall also be suitable for:

- The housing of the integral data logger and the temporary housing of a battery powered data logger which could periodically be used in conjunction with the water meter.
- The permanent housing of any lightning protection system.
- The permanent housing of GPRS transmitter and battery pack, and any other items necessary to facilitate communication with the central UFW SCADA system.
- Mains pressure recording – see (a) blow

Except where the cable is underneath the concrete plinth, there shall be a minimum of 500 mm cover for the cable. The cable shall be surrounded by sand bedding at least 75 mm thick and interlocking cable protection tiles shall be installed above the cable. An 'electric cable' warning tape shall be installed above the tiles. Wherever practicable, the cable shall be installed at least 600 mm away from any other cables.

Details of the sensor, including its diameter and the size of main together with a unique reference number, shall be permanently indicated on the outside of the cabinet enclosure housing the electronic display unit.

(a) Pressure Monitoring

A pressure tapping shall be made in the pipeline adjacent to the electromagnetic district meter for pressure monitoring. A pressure transducer shall be connected to the pressure tapping, with the connector and signal cable sealed to IP68 standard. The pressure signal cable shall either be integral with the meter signal cable or bundled with it and connected to the electronic display unit in the steel cabinet enclosure through a protective PE sleeve. Wherever the protective PE sleeve is above ground it shall be further protected, for example by installing it within a mild steel pipe or if the enclosure is post mounted, within the post itself.

✓