

WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION E-83-03

ELECTRO-MAGNETIC FLOWMETER

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WATER SUPPLIES DEPARTMENT
STANDARD SPECIFICATION E-83-03
ELECTRO-MAGNETIC FLOWMETER

1. GENERAL

This standard outlines the technical requirements of flowmeters which operate on the principle of electro-magnetic induction. The flowmeter shall consist of an in-line flow detector head and a separately mounted flow converter/transmitter for producing a current and pulse output directly proportional to the liquid flow rate. The design, operation and calibration of the flowmeter shall comply with the latest version of relevant standards as listed below or other international standards currently enforced on the date of tender invitation where applicable:

ISO 6817	Measurement of conductive liquid flow in closed conduits - Method using electromagnetic meters
IEC 60529	Degree of protection provided by enclosures (IP code)

2. DESIGN

The flowmeter shall meet the following design requirements:

(a) Overall Performance

Accuracy : Better than $\pm 0.5\%$ for flow rate ranging from 20% to 100% of the total flow of the flowmeter (for potable water, sea water and raw water applications)

Better than $\pm 1.0\%$ for flow rate ranging from 20% to 100% of the total flow of the flowmeter (for slurry and sludge flow applications)

Linearity error : Better than $\pm 0.2\%$ of the span

Repeatability : Less than $\pm 0.1\%$ of the span

Total power consumption	:	<table border="1"><thead><tr><th>Nominal pipe size (mm diameter)</th><th>Total power consumption (VA)</th></tr></thead><tbody><tr><td>< 1000</td><td>< 30</td></tr><tr><td>≥ 1000</td><td>< 80</td></tr></tbody></table>	Nominal pipe size (mm diameter)	Total power consumption (VA)	< 1000	< 30	≥ 1000	< 80
	Nominal pipe size (mm diameter)	Total power consumption (VA)						
	< 1000	< 30						
≥ 1000	< 80							

(b) Flow Detector Head

- Enclosure rating : IP68 to IEC 60529 for continuous 8 hours submersion at 5 m depth
- Field excitation : Pulsed d.c. field from flow converter
- Metering tube : Stainless steel of Grade 304 or otherwise specified in the Particular Specification
- Lining material : Elastomer or other approved material suitable for use in potable water applications, and Hard Rubber or PTFE (Teflon) or other approved material suitable for use in salt water and sludge applications
- Electrode material : Stainless steel of Grade 316 for potable and raw water, Hastelloy 'C' or Titanium for sea water
- Pressure effect : Less than 0.15% over the operating range of flowmeter
- Temperature effect : Less than $\pm 0.05\%$ of flow rate per 10°C

(c) Flow Converter / Transmitter

- Enclosure rating : IP 65
- Input signal : Induced e.m.f. from flow detector head
- Output signals
- (i) current : 4 - 20 mA d.c. for load up to 500 ohms
 - (ii) pulse : 24V/200 mA d.c. pulses with pulse rate up to 10 pulses/sec. suitable for driving a pair of electromechanical counters each with coil resistance of 430 ohms nominal
- Low flow signal cut off : Automatic output signal cut off at less than 1% of the full scale flow range with resumption of normal measurement at flow above 2%
- Signal averaging time : Field adjustable between 0-5 sec
- Supply voltage effects : Less than $\pm 0.1\%$ of the calibrated span per $\pm 10\%$ change in supply voltage
- Frequency effects : Less than $\pm 0.1\%$ of the calibrated span per $\pm 2\%$

change in supply frequency

- Temperature effects : Less than $\pm 0.15\%$ of flow rate per 10°C
- Power supply : 220V 50 Hz or 24V d.c. as detailed in the Particular Specification
- Diagnostic : Self monitoring with fault diagnostic functions including self calibrating the accuracy of signal processing
- Programming : Socket provided capable of linking for interface to a laptop PC computer

(d) Particular Requirements for Flow Converter / Transmitter

- Digital communication : Wire or wireless HART interface / other interface shall be capable of communicating with on-hand DCS or PLC control system
- Diagnostic / Calibration : Continuous self-checking, with alarms, of both sensor and transmitter accuracy with automatic calibration adjustment during normal running
- Additional output signals : Status and alarm warning

3. CONSTRUCTION

3.1 Flow Detector Head

The flow detector head shall be flanged at both ends. It shall be suitable for installing in the pipeline between a fixed flange at the upstream end and a straight pipe edge at the downstream end by means of a flange adaptor. The detector head shall be constructed from non-magnetic material lined with a non-corrodible insulating material compatible with the liquid being measured and of the required pressure rating. The field excitation coil assembly shall be epoxy resin encapsulated. The complete housing, including cable termination, shall have a certified degree of protection to IEC 60529 IP 68 for continuous 5 metres water submersion for 8 hours. External cable connections for field excitation and signal transmission shall be made via a sealable die-cast termination box or water-tight plugs and sockets. The cable shall be screened with suitable mechanical protection.

Suitable earthing arrangements shall be provided at both sides of the flowmeter. Where the flowmeter is specified to be installed in a pipeline with cathodic protection, insulating flanges, bonding bars etc. shall be provided to avoid any electrical interference to the flowmeter. Resilient gaskets shall be supplied for fitting between the flanges of the detector head and the pipeline. The gasket material shall be

chemically resistant to the measured liquid.

The design and construction of the electrode assembly shall prevent any ingress of water into the detector coil housing.

A liquid sensing electrode or an equivalent device shall be provided to nullify the flow signal output when the metering tube is only partially filled with water.

3.2 Flow Converter

The enclosure of the flow converter shall be of IP 65 to IEC 60529. The electronics package shall be of the withdrawable type to allow easy access to the PCB for testing or fault diagnosis under operating conditions. Local flow rate indication shall be provided at the flow converter. Alarm contacts for high/low flow rate shall be provided.

Where the flowmeter is required for bi-directional flow measurement, separate analogue and pulse signal outputs for forward and reverse flow conditions shall be provided with a volt-free contact to indicate the reverse flow condition. Furthermore, the flanged adaptors at both ends of the flowmeter should be of adequate length to enable the measurement for forward and reverse flow conditions.

4. ACCESSORIES

Each flowmeter shall be provided with the following accessories:

- (a) One set of earthing attachment for each end of the flowmeter, and
- (b) 50m of screened cables for field excitation and signal transmission between the detector head and flow converter.

5. CALIBRATION AND TESTING

Each flowmeter shall be tested and flow calibrated on certified testing apparatus at the manufacturer's works or other approved flow calibration facility with calibrated test equipment traceable to National or international standards. The following tests shall be conducted: -

- (a) pressure test to 150% of the required working pressure for 30 minutes;
- (b) flow calibration for the complete flow detector head and flow converter to verify the accuracy over the full flow range in accordance with ISO 6817; for bi-directional flowmeters, separate tests shall be carried out with water flow in normal and reverse directions; and

- (c) degree of protection of the flow detector head to IEC 60529 IP 68. Type test reports/certificates will be accepted as an alternative.

Details of the flow calibration test including the flowmeter test rig arrangement and calibration methods shall be submitted in the tender for assessment. All test results/certificates for the flowmeter shall be submitted to the Water Supplies Department prior to delivery of the equipment.