

Large Water Flow Laboratory

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CERTIFICATE OF CALIBRATION

**ELNBAR - Multiparameter Measurement Sensor
of size 600 mm NB From**

**M/s. INDEXEL ENGINEERING PRIVATE LIMITED,
GI-12, IT Park , Road No.4, IPIA
Rajasthan - 324005**

CERTIFICATE NUMBER

Certificate Number : C50/240632/011

ULR:CC239524500000011F

एफ.सी.आर.आई.



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An ISO 17025 : 2017, 9001 : 2015 Establishment

An Autonomous R&D Organisation under Ministry of Heavy Industries, Govt. of India.

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Large Water Flow Laboratory

Date of Receipt	Date of Calibration	Date of Issue
08.07.2024	09.07.2024	19.07.2024

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SUMMARY

Test meter	ELNBAR - Multiparameter Measurement Sensor (refer section. 1 for details)
Standard for Reference Flow meters	ISO TR 6817 Measurement of conductive liquid flow in closed conduits – Method using Electromagnetic flow meters.
Laboratory	Large Water Flow Laboratory (LWFL)
Calibration Results	The result of calibration is given in Table 1 and summary of result in Section 4.
Traceability	All the Instruments / Reference flow meters used are traceable to national standards through reference standards and their calibrations are valid.

Calibrated by

Manikandan S

Ashiq Rahiman N

Prepared by

Ashiq Rahiman N

Checked & Approved
Signatory by

Manikandan S



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1. Specification of Flow meter Calibrated.

FLOW ELEMENT	: ELNBAR - Multiparameter Measurement Sensor
SIZE	: 600 mm NB
MAKE	: Electronet Equipments Pvt Ltd
MODEL NO.	: Insertion EMF Meter
SERIAL NO	: ELNBAR-M-2324-50
CALIBRATED FLOW RANGE	: 6107.26 m ³ /h
METER FACTOR	: 1
DATE OF CALIBRATION	: 09.07.2024

2. Specification of Reference Instruments used

REFERENCE METER	RANGE	UNCERTAINTY	CALIB DUE DATE
EMF 1 (24")	5000 m ³ /h	0.25 %	21/12/2024
EMF 4 (24")	5000 m ³ /h	0.22%	22/12/2024
RTD	0-60 °C	0.070 °C	17/04/2025
DAS	4-20 mA	0.010 mA	01/04/2025
Pressure transmitter	0-10 bar	0.034 mbar	31/10/2024

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3. Method of Calibration

The meter to be calibrated was installed in the test line of large water flow laboratory. The line was flooded and entrapped air cleared using circuit air bleeds. Combinations of pumps were used for attaining the required flow rate. The flow rate was adjusted using the downstream control valve. When flow conditions had stabilized, the actual flow rate was measured using reference flow meters (EMF). A high precision Data acquisition module was used to acquire and average the flow rate indicated by the reference flow meters. Temperature of water was determined using on line RTD's and line pressure was monitored using a precision pressure transmitter. Current output from the test flow meter was also averaged and recorded through DAS. Percentage error of the test meter with respect to reference meter is recorded at different flow rates.

4. Result

- The results are tabulated in Table 1.
- The expanded uncertainty in the measurement flow rate is estimated to be better than 0.45%
- The expanded uncertainty quoted are standard uncertainty multiplied by a coverage factor $k = 2.87$ at a level of confidence of approximately 95 %.

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5. Table-1 Calibration Result

FLOW ELEMENT : ELNBAR - Multiparameter Measurement Sensor
SIZE : 600 mm NB
MAKE : Electronel Equipments Pvt Ltd
MODEL NO : Insertion EMF Meter
SERIAL NO : ELNBAR-M-2324-50
CALIBRATED FLOW RANGE : 6107.26 m³/h
METER FACTOR : 1
DATE OF CALIBRATION : 09.07.2024

Sl No	Pup bar	T deg C	p kg/m ³	Qa m ³ /h	Va m/s	C mA	Qc m ³ /h	Vi m/s	% Dev. in Qi
1	0.607	27.92	996.758	1517.200	1.552	7.969	1514.98	1.55	-0.036
2	0.607	27.92	996.758	1521.968	1.557	7.965	1513.46	1.55	-0.139
3	0.604	27.92	996.758	1532.966	1.568	7.946	1505.20	1.54	-0.438
4	0.595	27.96	996.758	3074.801	3.145	12.057	3075.39	3.15	0.010
5	0.595	27.96	996.758	3072.649	3.143	12.099	3091.42	3.16	0.307
6	0.592	28.00	996.730	3051.071	3.120	12.017	3060.12	3.13	0.148
7	0.667	28.01	996.730	4313.988	4.412	15.237	4289.21	4.39	-0.406
8	0.667	28.01	996.730	4330.258	4.429	15.326	4323.18	4.42	-0.116
9	0.667	28.01	996.730	4323.962	4.422	15.304	4314.78	4.41	-0.150
10	0.667	28.01	996.730	4324.738	4.423	15.350	4332.34	4.43	0.124
11	0.588	28.07	996.730	5298.073	5.419	17.933	5318.28	5.44	0.331
12	0.588	28.07	996.730	5307.116	5.428	17.932	5317.90	5.44	0.177
13	0.588	28.07	996.730	5305.012	5.426	17.975	5334.31	5.46	0.480
14	0.671	28.10	996.730	795.592	0.814	6.058	785.55	0.80	-0.164
15	0.671	28.10	996.701	793.722	0.812	6.108	804.63	0.82	0.179
16	0.671	28.10	996.701	795.892	0.814	6.081	794.33	0.81	-0.026
Repeatability (%)									= 0.108

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6. Sample Calculation

Qc	=	Flow rate obtained from current output	(m ³ /h)
Qa	=	Actual flow rate indicated by master reference meter	(m ³ /h)
% Dev in Qc	=	$\frac{(Qc - Qa) \times 100}{Qa \text{ wrt FS}}$	%

For SI.No.3 in Table 1

P _{up}	=	0.604	bar
T	=	27.92	deg C
ρ	=	996.758	kg/m ³
Qa	=	1532.966	m ³ /h
C	=	7.946	mA
Qc	=	$\frac{C - 4}{16} \times Q_{max}$	m ³ /h
Qc	=	1506.203	m ³ /h

a) Percentage deviation in indicated flow rate

$$\begin{aligned} \% \text{ Dev in } Q_i &= \left(\frac{1506.203 - 1532.966}{6107.260} \right) \times 100 \\ &= \underline{\underline{-0.438}} \% \end{aligned}$$

b) Calculation of repeatability

The repeatability was determined for the operating range (Table 1 SI.No.7 to 10)

$$\begin{aligned} \% \text{ Repeatability} &= \frac{\sigma_{n-1}}{\sqrt{n}} \\ n &= 4 \\ \sigma_{n-1} &= 0.217 \% \\ \% \text{ Repeatability} &= \frac{0.217}{\sqrt{4}} \\ &= \underline{\underline{0.108}} \% \end{aligned}$$

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7. Calibration Chart

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METER FACTOR	: 1
DATE OF CALIBRATION	: 09.07.2024

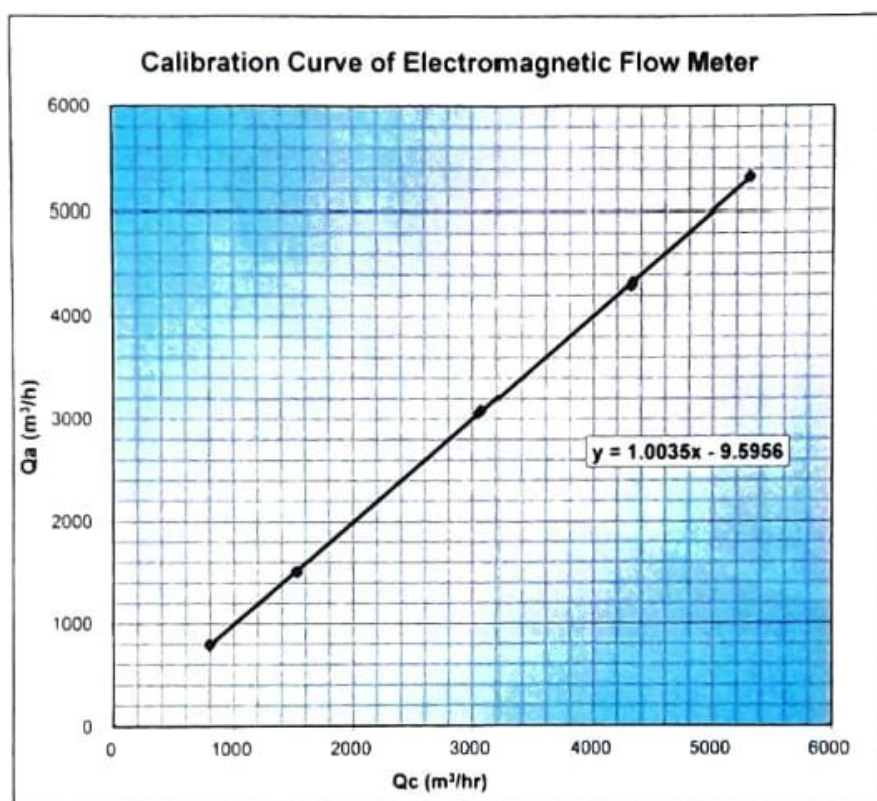


Fig: 1

S. Ananth