Nagman

Instruments & Electronics Private Limited
Chennai, India

TECHNICAL PRESENTATION – FLOW METER CALIBRATION SYSTEM

by

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Vice Chairman

NAGMAN
Since 1972

Brief about Nagman

- Nagman is an ISO 90001:2008 certified company and serving the global market since 1972
- Our calibration lab is accredited to NABL for Thermal, Mechanical, Electrical and Flow Parameters in accordance with IEC/ISO 17025:2005
- We provide complete solutions to Calibration needs and offer consultancy services.
- We have Ability in Design, Manufacturing, testing, Supply, Installation & , Commissioning and Maintenance under one roof.

Products & Services

A. Portable Calibrators – Temperature / Pressure / Signal

B. Dead Weight Tester / Comparator

C. Test Benches / Work Stations

D. Flow Meters & Water Meters Calibration System

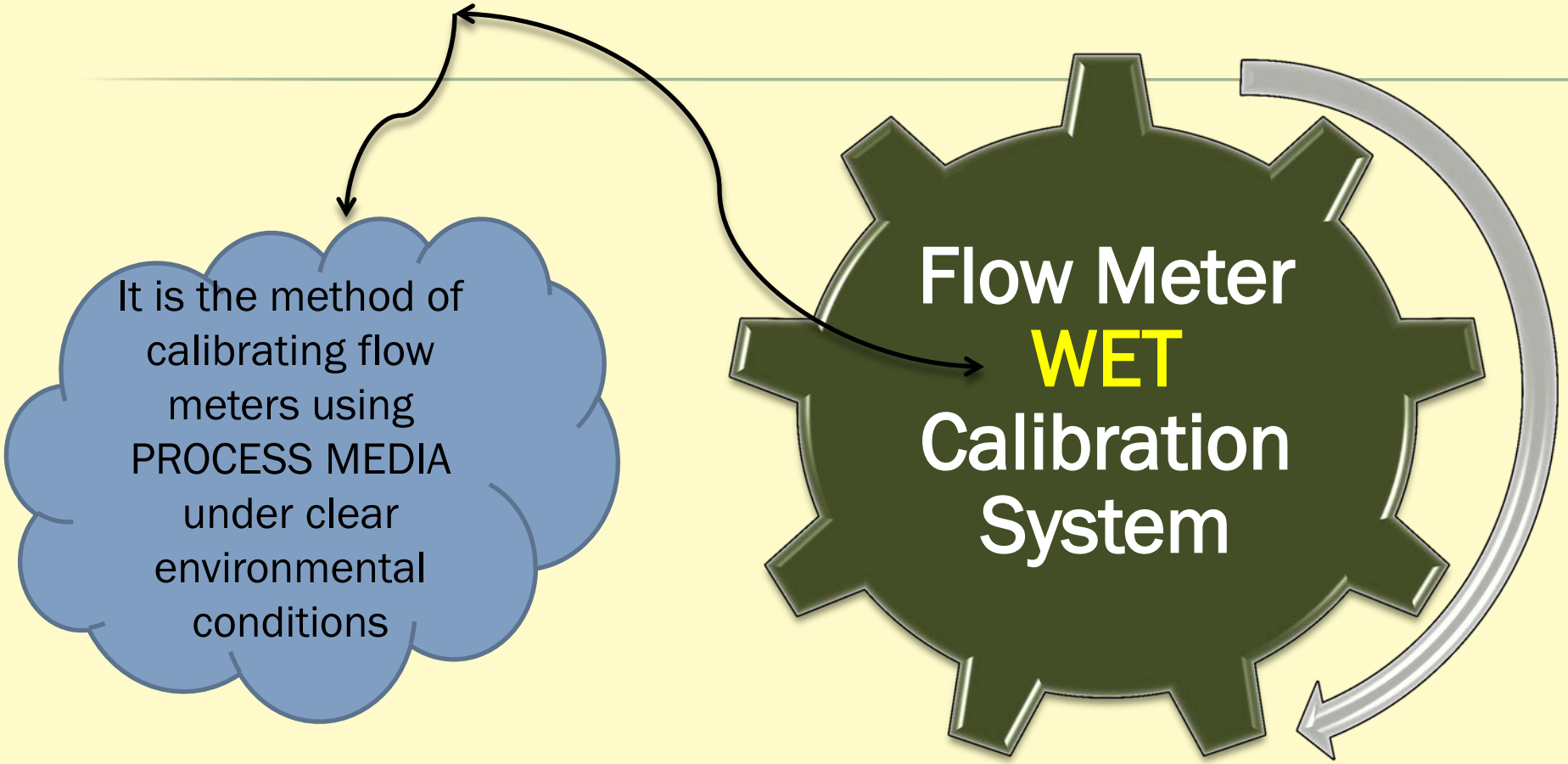
E. Level Calibration System

F. Domestic Gas Meter Calibration System (Bell Prover)

G. Process Flow Meters

H. Level Transmitters / Devices

I. Calibration Services - ISO 17025 accredited

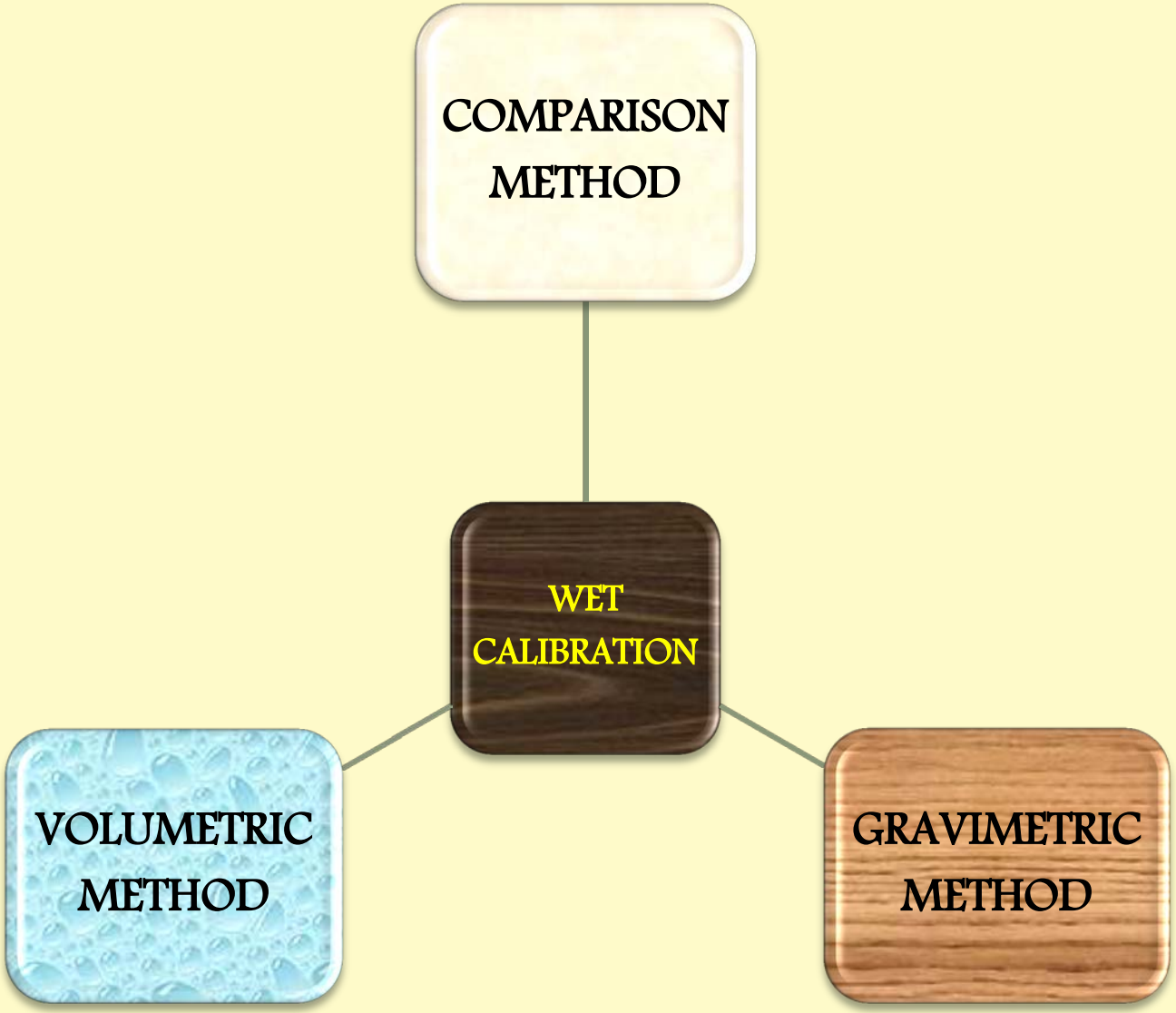

It is the method of calibrating flow meters using PROCESS MEDIA under clear environmental conditions
Flow Meter
WET
Calibration
System

Why Flow Meter Calibration

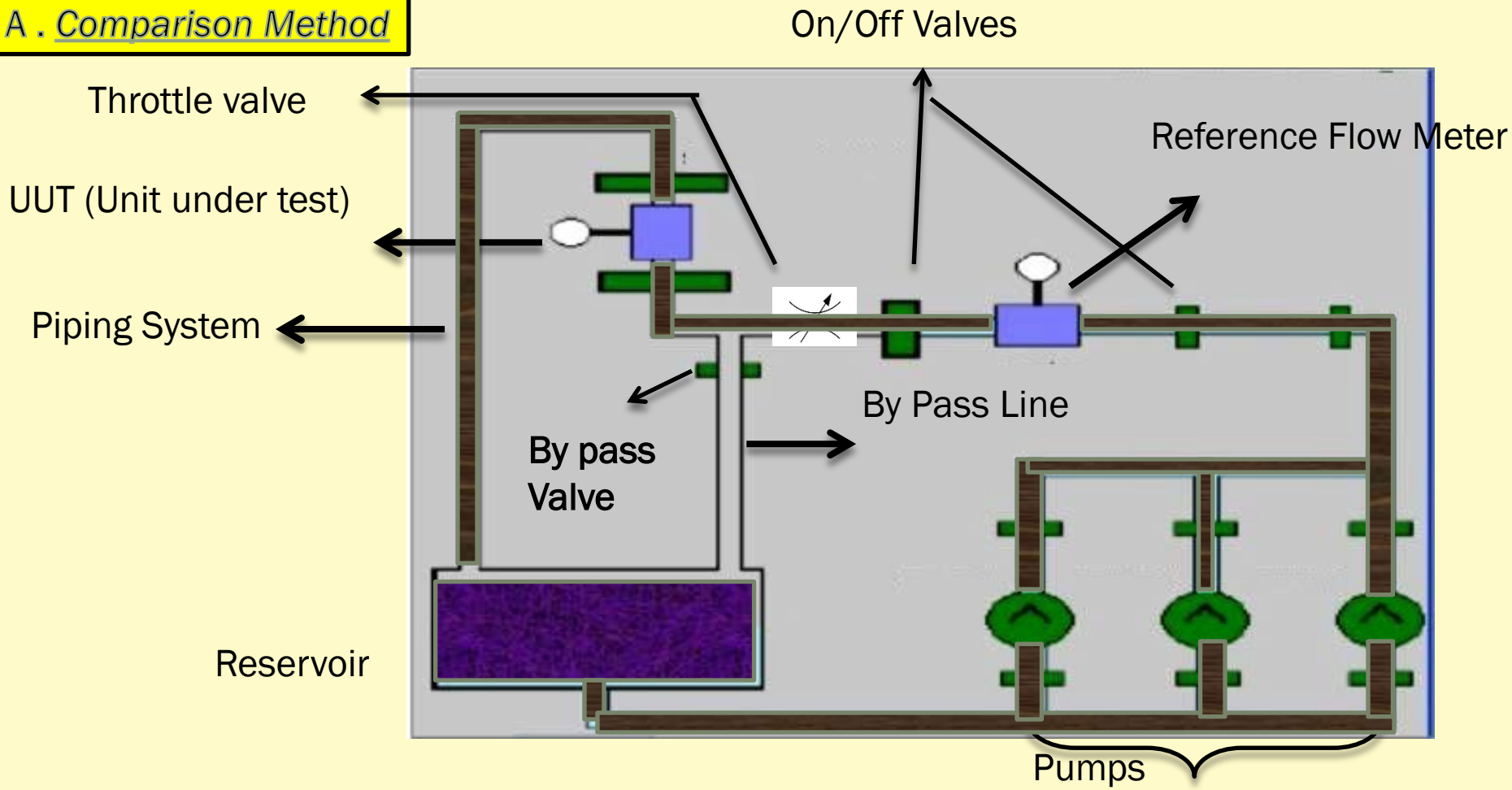
- Flow meters readings tend to drift due to changes in Temperature, Pressure and Harsh Environmental conditions.
- Meters used in Custody transfer application should be precise.
- Quality systems viz..ISO / TS/TQM demands periodical calibration
- For the Safety and Security of the personnel.

Recommended calibration frequency is atleast once in a year

Techniques of Fluid Flow – WET calibration



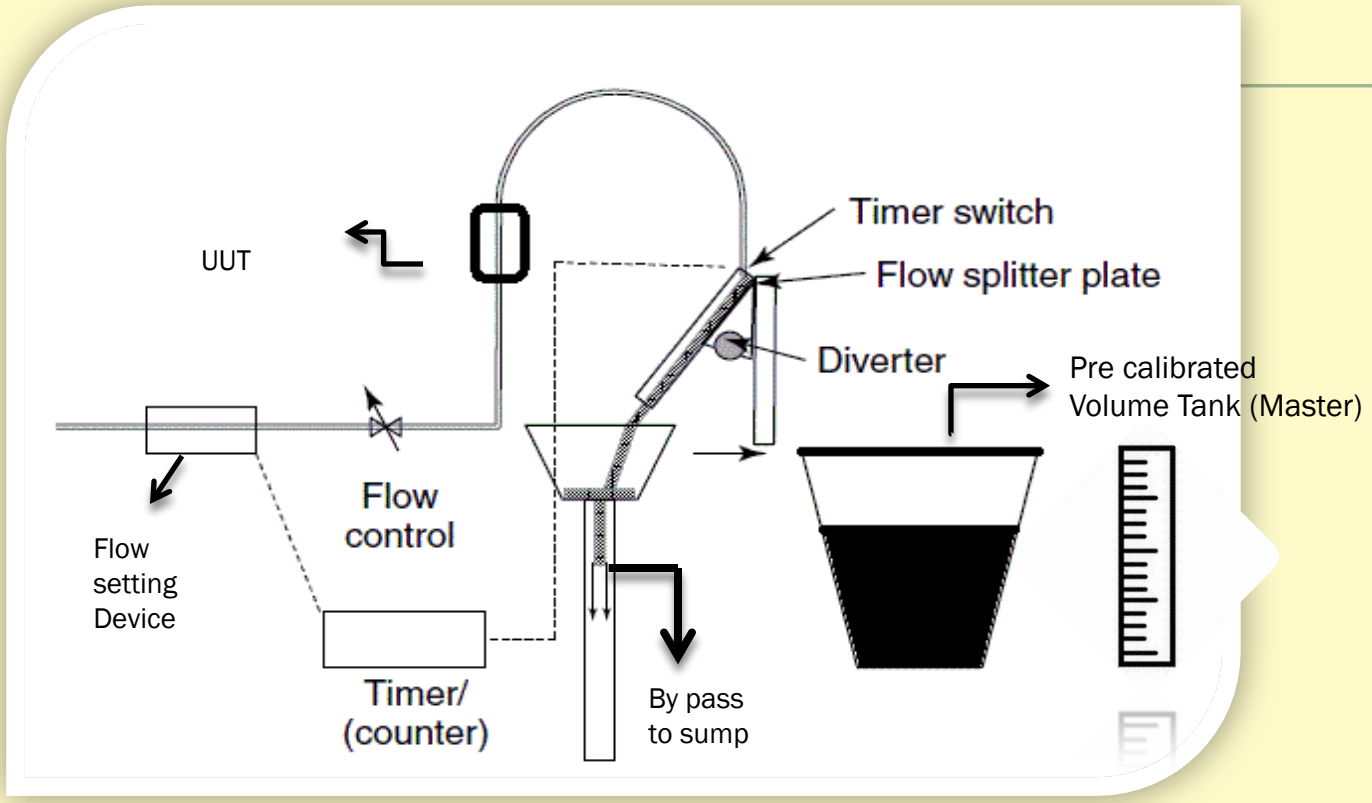
A . Comparison Method



Desired flow rate is set using the pumps (VFDs) and throttle valves. The volume & flow rate of UUT is compared with the reference meter to estimate the accuracy of UUT. The accuracy of the system depends on the accuracy of the Master meter.

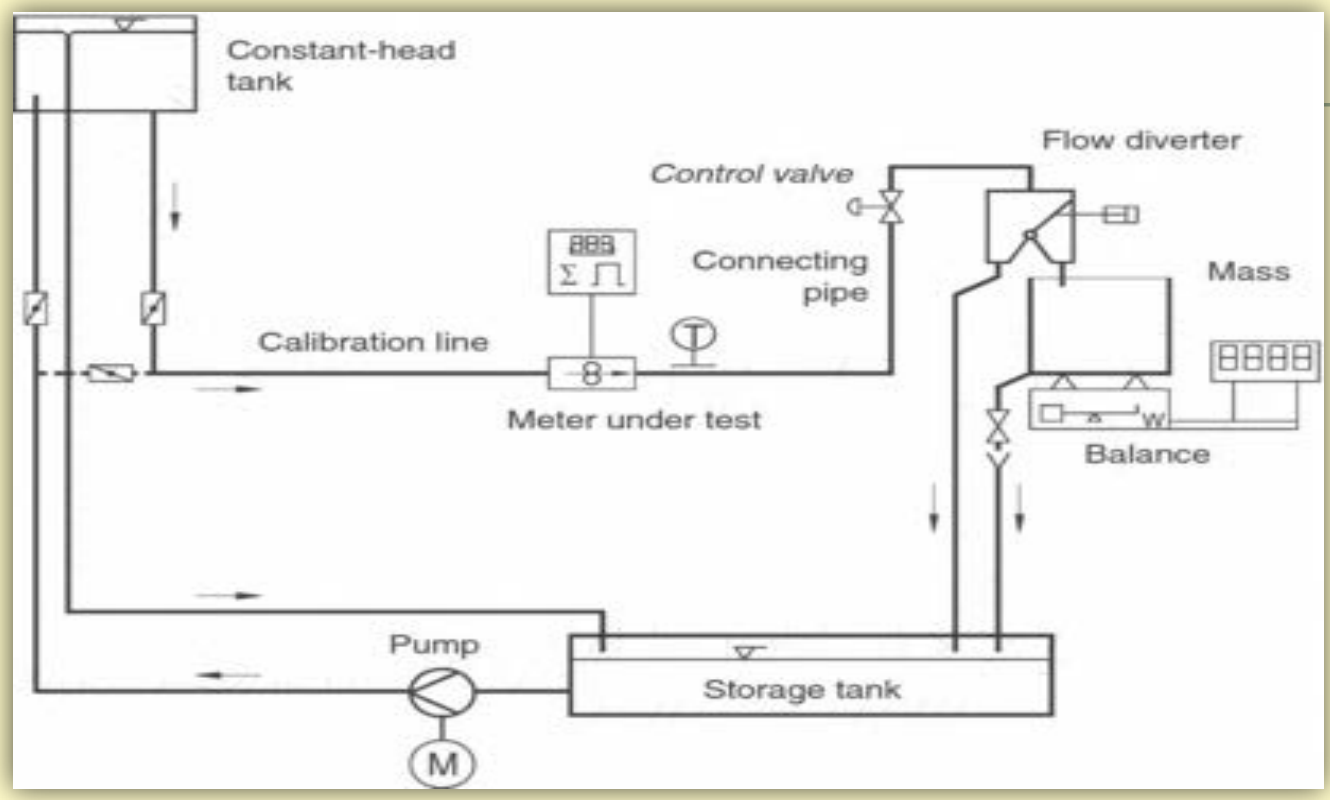
Typical Calibrated accuracy of Master 0.2%
(Achievable Up to 0.05%)

B. *Volumetric Method*

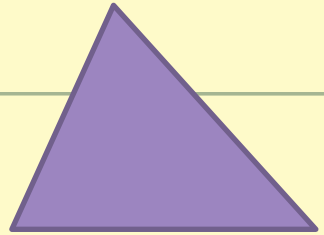


Pre fabricated volume tank is used as a Master reference. Water is getting diverted between Sump and collection tank for precise volume measurement. UUT reading is compared with volume of water collected in the tank. Typical calibrated accuracy of Master is 0.1%

C. *Gravimetric Method*



MASS



Density Volume

Uncertainties (CMC) up to 0.05%

High resolution weighing scale is used as a reference. After setting the required flow rate , the diverter is activated to collect the water in the collection tank to measure the mass of water using the weighing scale. Water density is also measured through a high accuracy density meter. Both Mass of water and Density are used to calculate the volume which is compared with the reading of UUT.

Typical Flow meter calibration Systems

NABL accredited as per ISO 17025

Method	Gravimetric
Flow range	up to 6000 LPM
Meter Sizes	DN 6 to DN 150
Flow control	Semi Automatic

Method	Gravimetric
Flow range	up to 25,000 LPM
Meter Sizes	DN 6 to DN 400
Flow control	Fully Automatic

Salient Features of the system

- **Water Media Calibration with "Correction Factors" for other Liquids**
- **Calibration of Multiple UUT's Simultaneously**
- **Effortless / Ergonomic Clamping / Mounting System – Manual / Pneumatic / Hydraulic / Electrical Actuators**
- **Adjustable Flow Rate over the Span**
- **Sizes: DN 6 to DN 400**
- **Flow Rates: 1 LPM up to 25,000 LPM**
- **No. of Lines: 1, 2 or 3 to suit**

Salient Features of the system – Contd..

- Display / Control Console: Flow Rate, Total Flow, Start / Stop Timer etc.,
- Fully Automatic System with pre loaded FLOCAL software , PLC & HMI mounted on electronic console
- Flow setting through high accuracy EMF meters
- Four Stainless Steel Tanks of Nominal volumes 150 Ltrs., 600 Ltrs., 6000 Ltrs. & 12000 Ltrs.
- Fine Flow control through Electrically Operated Flow Control Valves
- Flow Diverter Systems (DN25,DN50,DN150,DN250) that enables/divert Flow into Collection Tanks / Water Reservoir for Flying Start/Stop Operation.
- High resolution weighing scales as a MASTER reference

Key Modules of FLOCAL System

- **Storage Tank / Water Reservoir**
- **Pumps for water Supply**
- **Variable Frequency Drives (VFDs) for Flow Control**
- **Water Filter (Off Line)**
- **Test Bed**
  - **On/Off Valves**
  - **Clamping Systems**
  - **Adaptors & Spacers**
  - **Flow Straighteners**
  - **Pressure Measurement Devices (inlet / outlet)**
  - **Temperature Measurement Devices (inlet / outlet)**

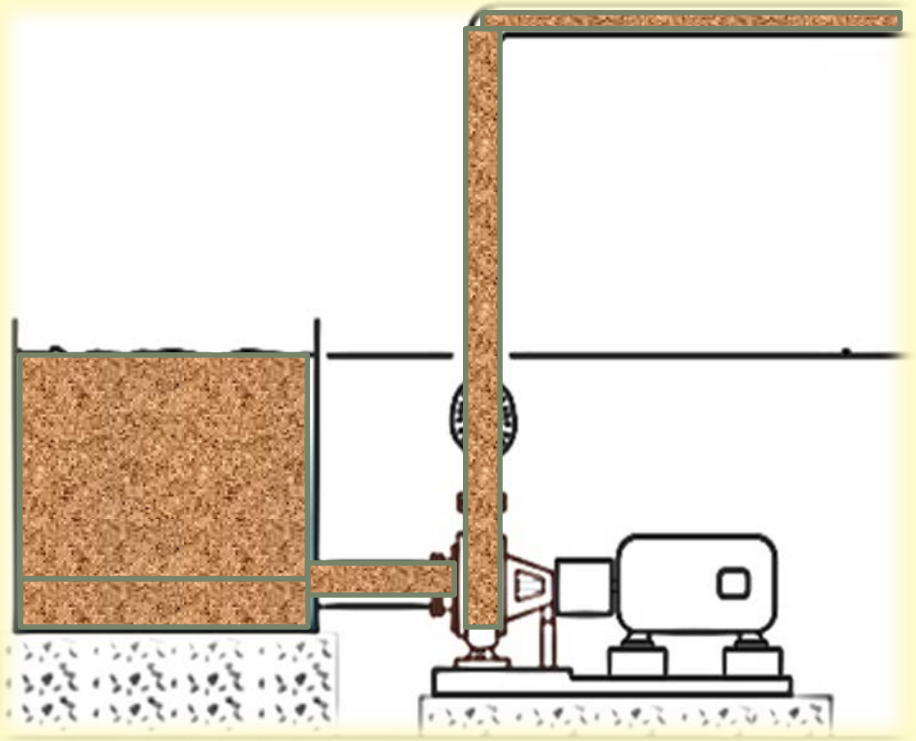
Key Modules - contd

- Electro Magnetic Flow Meters (Flow Setting / Reference Device)
- Weighing Scales With Collection Tanks
- Diverter System
- Automatic Read out System - Optical Heads (or) Digital Cameras
- Electronic Control Console , PLC , HMI , SCADA
- FLOCAL Software
- Computer System

Types of Flow Meters that can be Calibrated

- Variable Area Flow Meter (Rota Meter)
- Turbine / Impeller
- Positive Displacement
- Vortex
- Electro-Magnetic
- Coriolis / Thermal Mass
- Ultrasonic
- Primary Flow Elements

STORAGE TANK / WATER RESERVOIR



Flow Calibration System can operate without the availability of an external water supply source (Except for Topping up once in a way) Using only the water in the Storage Tank / Water Reservoir & on Recirculation Mode.

PUMPS & VFD

Adequate No. of Pumps provided to suit required Flow Rate . Pumps are mounted with frequency Drives (VFD) to control complete water circulation between the Reservoir / Storage Tank & Collection tanks.

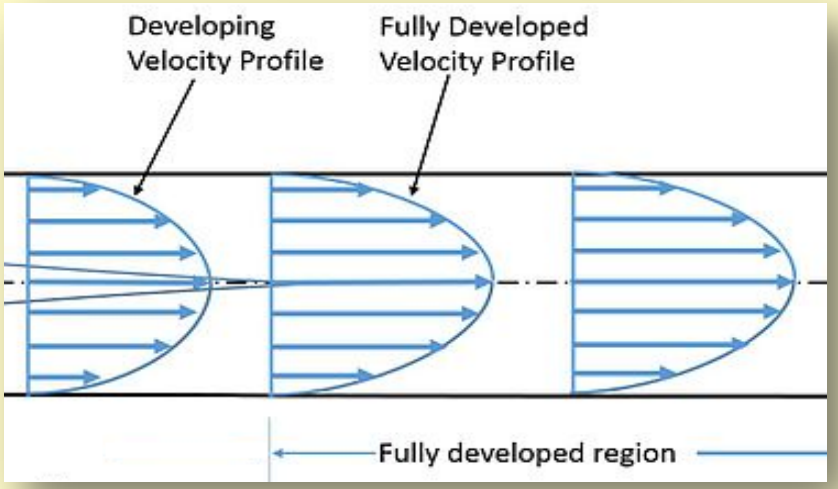
FLOCAL

TURBULENCE EFFECT

Designed with the 'Objective' of minimizing the Turbulence created by Water Flow from the Pump discharge by passing through a 3 level perforated Sheet filter Embedded inside the tank (Air Vent / Bleeder Valve provided)

Damping Tank

Flow Straightener

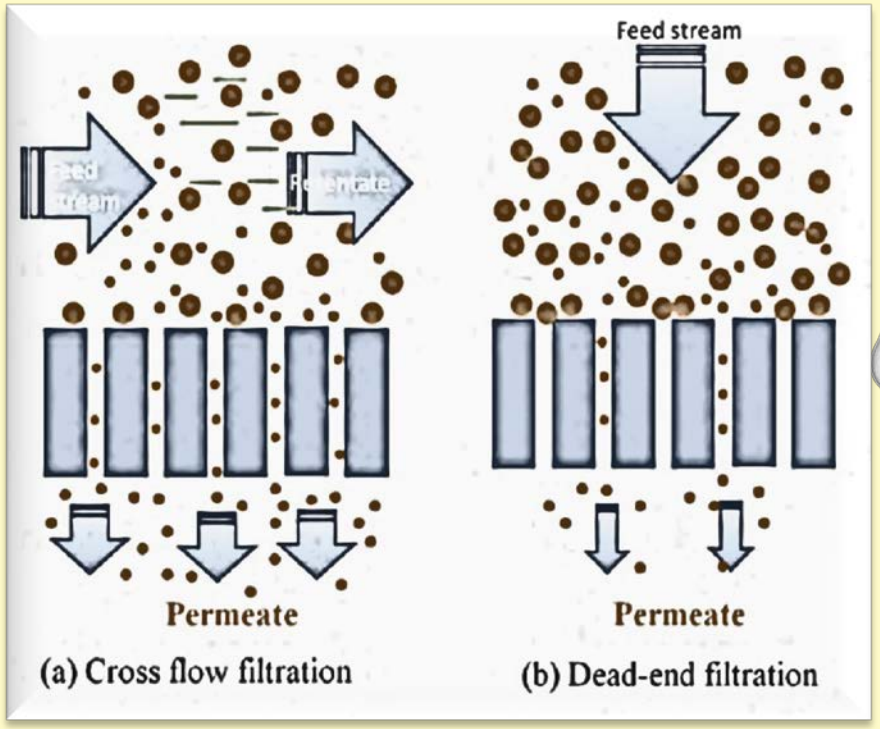


Flow straightener is used in side the pipe line to avoid turbulence and obtain better Reynolds number.

TURBULENCE EFFECT – Contd..

Headers are provided at inlet / outlet of the test bed to minimize the turbulence of water flow.

WATER FILTER (Off line)



Water filter provided on the Test lines to prevent clogging and unacceptable impact on the measurement results and the meters.

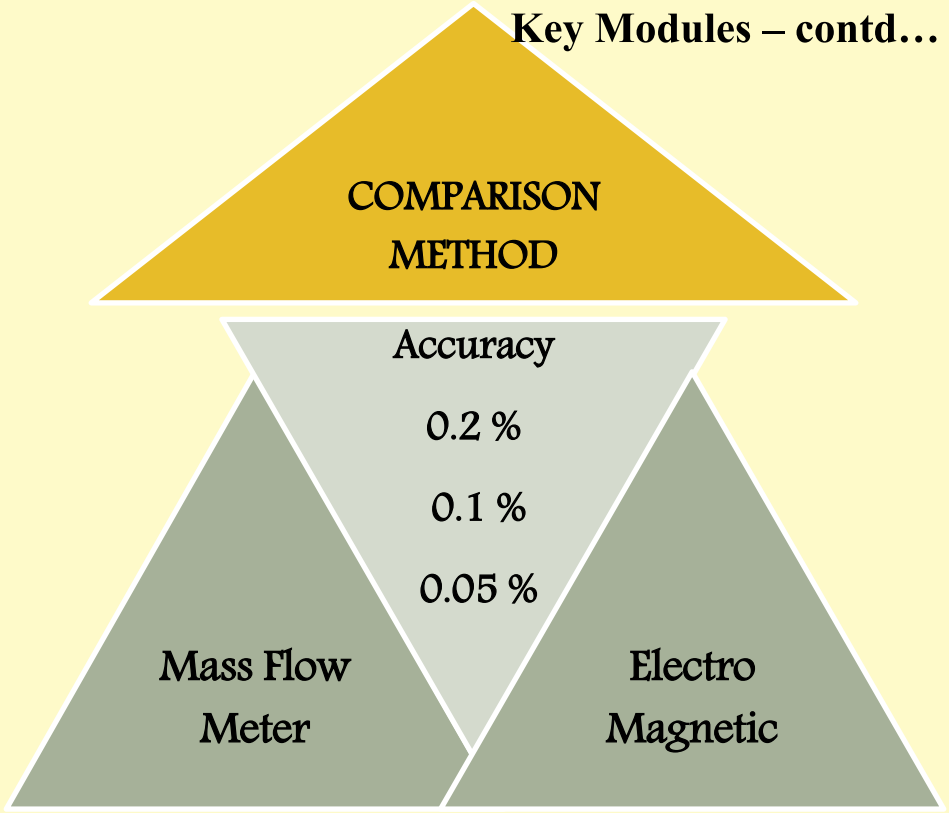
TEST BED / LINE

Flow Meters of Sizes up to DN 400 can be tested at the same bench.

Multiple flow meters of smaller sizes can be tested.

1/2/3 or more Test lines can be designed to suit the Meter Sizes

Master / Reference



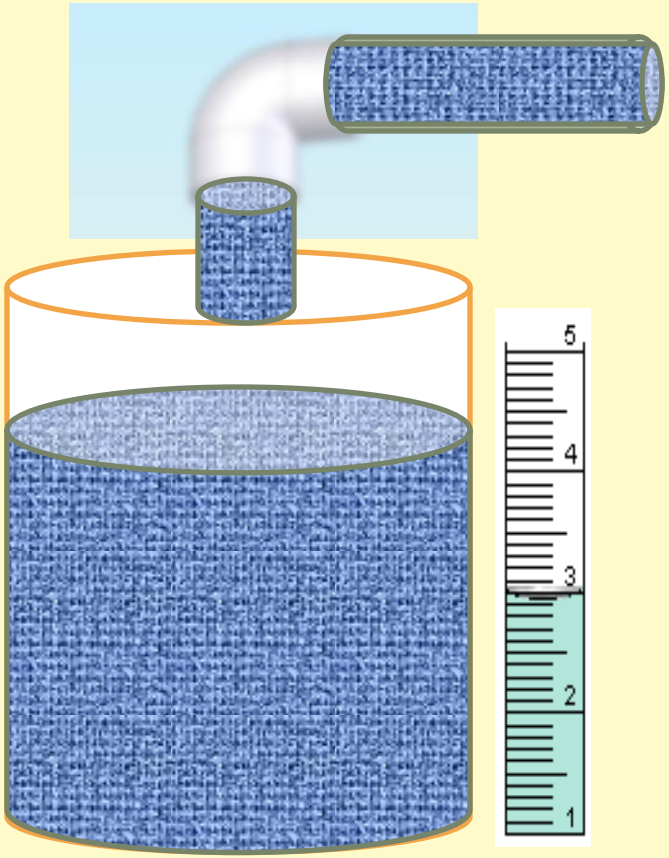
FLOCAL

Master / Reference - contd

Volumetric Method

Pre Calibrated Graduated Tank

0.1 % accuracy



FLOCAL

Master / Reference - contd

Gravimetric Method

High Resolution Weighing Scale

Multiple scales w.r.t flow range

System Uncertainty (CMC) – 0.05%

FLOCAL

Key Modules – contd…

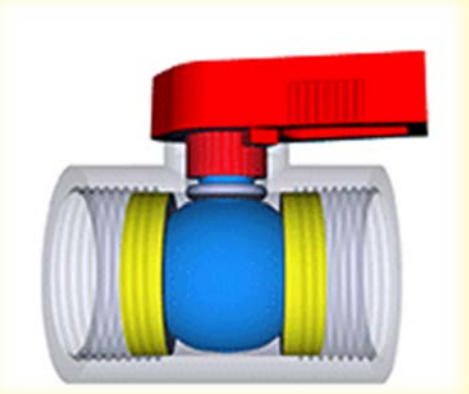
Pressure Transmitters at the up / down stream of the test lines.

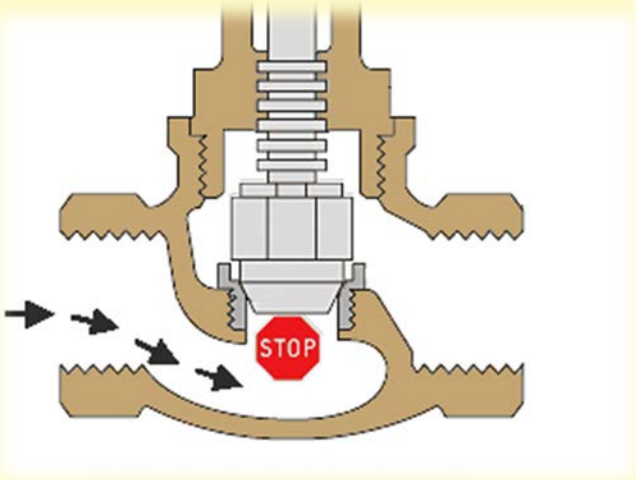
Two Temperature Transmitters at the inlet and collection tank

Key Modules – contd…

Manually (or) Actuated valves – Based on Customer Request

- **For Water Supply**
- **For Testing Lines**
- **For Flow Reference / Setting Devices**
- **Drain Lines**



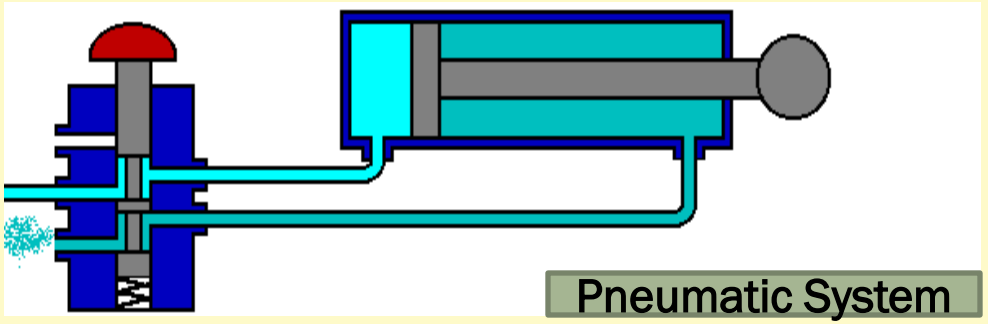


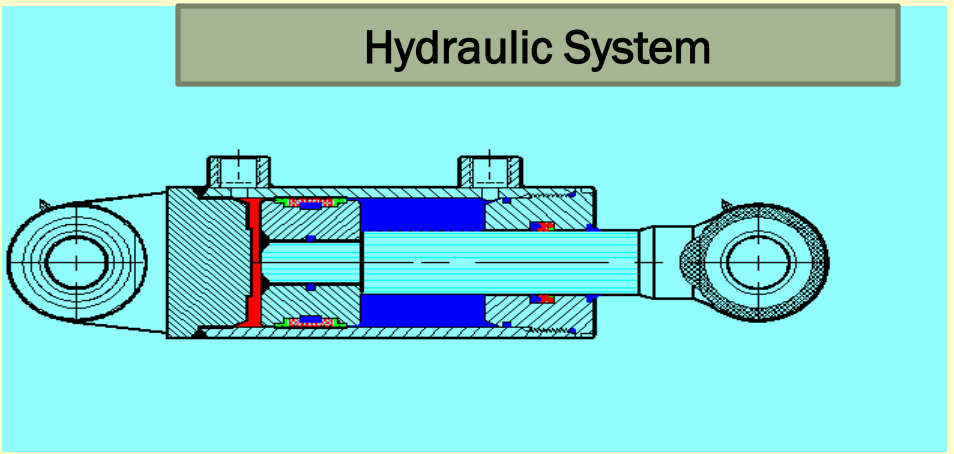
Key Modules – contd…

Clamping System

High quality Pneumatic (or) Hydraulic clamping system to clamp UUT's.

Air compressor with 6 bar pressure for pneumatic system.





Key Modules – contd…

Adaptors / Spacers / Blanks will be provided for Matching / connecting Various Sizes of Meters

High Quality supports for the Pipe line UUTs & Master Meters.

High resolution digital cameras & optical sensors used for automatic capturing of Data from UUT.

Flow Diverter will enable divert Flow into Collection Tanks/Reservoir (Storage Tank) for Flying Start/Stop Operation without disturbing the Flow Rate.

High accuracy TIMER

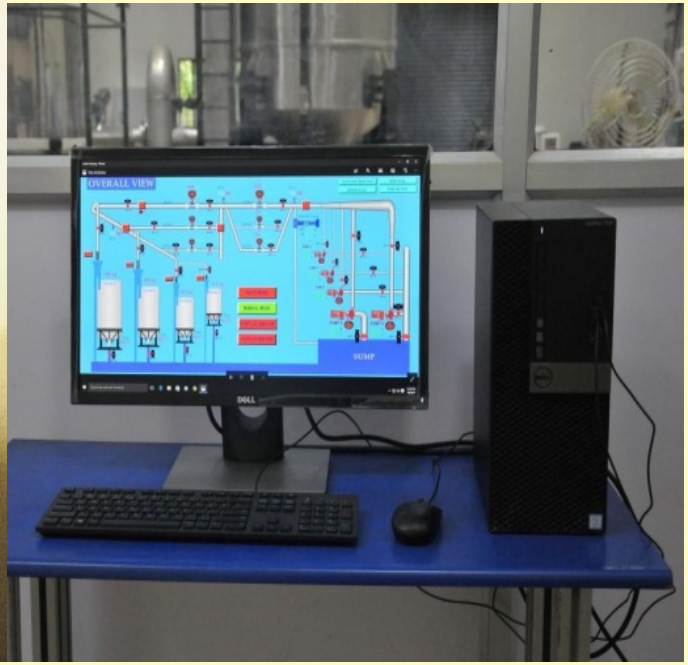
Flow Diverter in Operation - Video

Collection Tanks ……of capacities up to 12,000 Liters will be provided to collect the water flow during Campaign & These Collection Tanks will be placed on Matching Precision Weighing Scales up to 12,000kg – used as `MASTERS'

Electronic Console

To display Rate of flow, start / stop timer, selection of valves for UUT, selection of Master meters, VFD control knob (Flow Rate Control), temperature indicator, pumps on/off control through which the entire calibration process / operation can be performed.

SCADA SYSTEM



Some typical Systems

PICs Arabia – Saudi Arabia

Gravimetric System

Fully Automatic Flow Control

DN 15 to DN 250

High Resolution Weighing Scales

BPCL – Mumbai, India

Comparison System

Manual Flow Control

DN 8 to DN 80

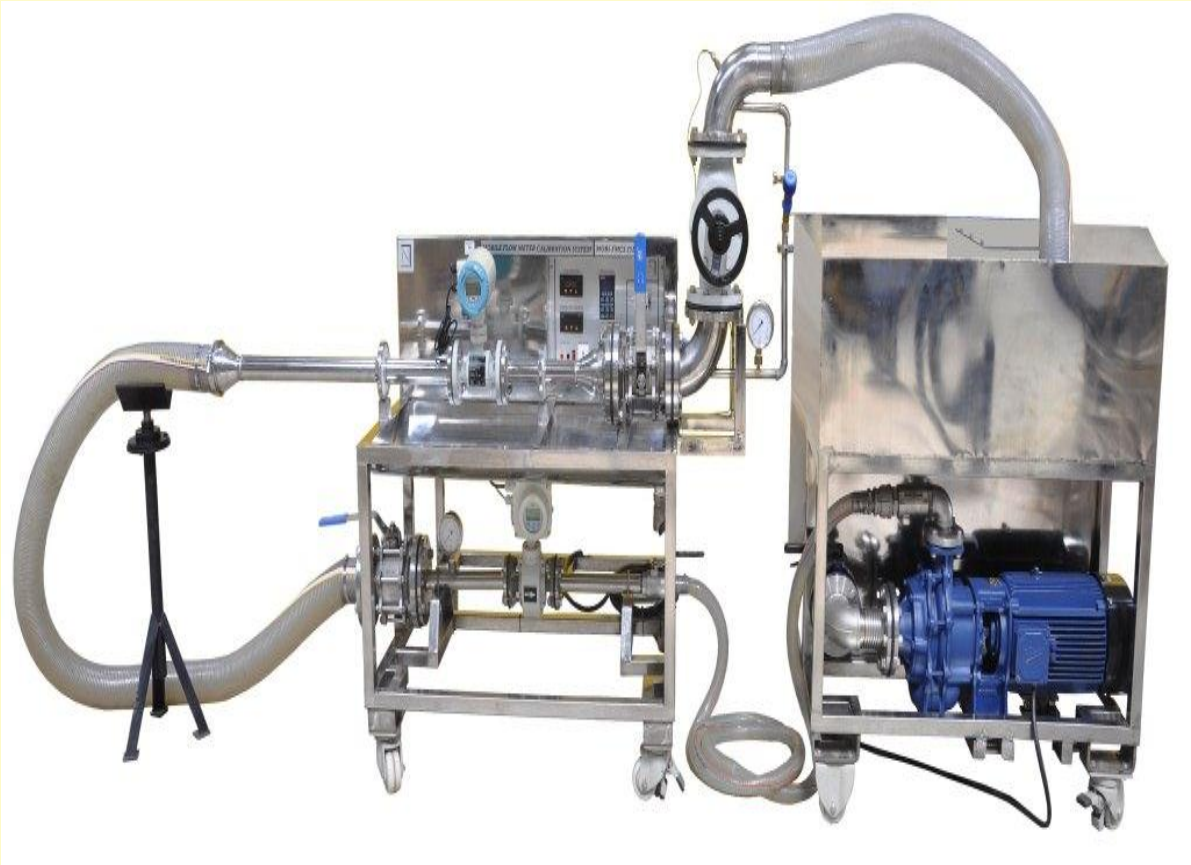
Reference Mass F/M – 0.1% acc

TATA STEEL - Kalinga nagar, India

Comparison System ; Manual Flow Control ; DN 15 to DN 250

Reference Electro Magnetic F/M – 0.2% acc

Mobile Flow Calibration System – ARIL - Kenya



Comparison System

Manual Flow Control

DN 6 to DN 100

Reference Electro Magnetic F/M – 0.2% acc

Mobile Flow Calibration System – SKID Mounted

Gravimetric System

Manual Flow Control

DN 6 to DN 80

Reference High Resolution Weighing Scale

Typical Calibration Certificate

Job No. 028 **Certificate No.** 2016-17 / CFC-FL / 049

Customer Name and Address	M/s. Indian Oil Corporation Limited, (Refineries Division), P.O.Barauni Oil Refinery, Begusarai - 851114.
Customer Reference	PO.No: RBRM151041/24753096 Dated 05.05.2016
Details of the Instrument	
Location	-
Description	Mass Flowmeter
Make	Nagman
Model	NAGMASS 25- LZYN-25Y1U2S4.0
Serial number	LN160101
Identification Number	-
Size	DN 25
Flow Range	8000 kg/h
Resolution	0.01 kg
Accuracy	± 0.1%
Calibration Procedure	ISO 4185-1980 (CFC-FL/WI/F-02)
Equipment received on	09.06.2016
Condition of the equipment on receipt	Good
Date of calibration	13.06.2016
Date of next calibration suggested	13.06.2017
Calibration environments	
Temperature	31.5°C
Relative humidity	61% RH

Standard Instrument Details

Description	Range		Uncertainty		Due Date
Weighing System	100	kg	0.0201	kg	12.12.2016
Pressure Transducer with Indicator	10	bar	0.0006	bar	01.09.2016
Temperature indicator with sensor	100	℃	0.2	℃	24.09.2016

The Standards used are traceable to National / International Standards

NAGMAN

CALIBRATION DATA

Flow Element Mass Flowmeter

Size DN 25

Flow Range 8000 kg/h

Calibration Fluid : Water

S. No.	Pup	W1	W2	T	Flow rate	Wa	Wt	Dev in Wt	Exp.Unc ±
	bar	kg	kg	°C	kg/h	kg	kg	%	%
1	0.70	0.86	42.70	31.5	800	41.8844	41.92	0.085	0.12
2	0.70	1.10	42.94	31.5	800	41.8844	41.92	0.085	
3	0.71	2.04	43.90	31.5	800	41.9044	41.94	0.085	
4	0.73	1.06	47.52	31.6	2000	46.5092	46.54	0.075	0.12
5	0.73	2.24	48.70	31.6	2000	46.5092	46.54	0.073	
6	0.73	1.52	48.00	31.6	2000	46.5293	46.57	0.077	
7	0.75	1.44	52.00	31.8	4000	50.6136	50.65	0.070	0.12
8	0.75	1.26	51.80	31.7	4000	50.5936	50.63	0.072	
9	0.75	1.68	52.22	31.6	4000	50.5936	50.63	0.072	
10	0.78	2.02	56.32	31.5	6000	54.3576	54.40	0.078	0.12
11	0.78	1.52	55.84	31.5	6000	54.3776	54.42	0.074	
12	0.78	1.74	56.04	31.6	6000	54.3576	54.40	0.069	
13	0.80	1.34	62.18	31.5	8000	60.9045	60.95	0.070	0.12
14	0.81	2.00	62.88	31.4	8000	60.9445	60.98	0.063	
15	0.81	1.96	62.82	31.4	8000	60.9245	60.97	0.068	


You!