

## FIELD OF ACTIVITY



Volume measurement

Liquid flow measurement

The Volume Laboratory provides calibrations to the industry, mainly for water meters manufacturers, fuel companies, verification offices, chemical, analytical and pharmaceutical laboratories. There are three separate facilities:

- Small volumes (glassware and piston operated volumetric equipment);
- Large volumes (standard test measures and proving tanks);
- Liquid Flow (Liquid dosing instruments and flowmeters)

## SI UNITS

### Derived unit of the International System (SI) of the quantity Volume (V):

**cubic meter (m<sup>3</sup>)** defined as: The volume of a cube with 1 metre edge.

### Non-SI unit accepted for use with the SI

The litre (L or l) can also be used as a measurement unit and it is equivalent to 0,001 m<sup>3</sup> or 1 dm<sup>3</sup>.

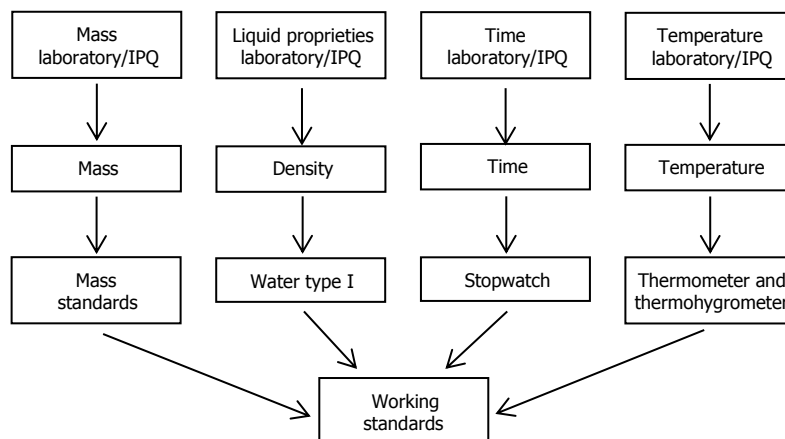
### Derived unit of the International System (SI) of the quantity Flow(Q):

**cubic meter (m<sup>3</sup>)/second (s)** defined as: the volume of fluid passing through a given area per unit time.








## TRACEABILITY

The traceability of the Volume Laboratory is established to the national mass standards, temperature standards, time standards and density of the used liquid.

### Traceability chain of the Volume and Flow Laboratory



## Calibration

EQUIPAMENT	RANGE	UNCERTAINTY	
Pycnometers	1 mL to 100 mL	0,003 %	
Micropipettes	1 µL to 20000 µL	(0,3 - 0,1) %	
Dispensers	0,001 mL to 200 mL	0,01 %	
Syringes and Microsyringes	0,001 mL to 200 mL		
Flasks	1 mL to 10000 mL		
Glass burettes	1 mL to 100 mL		
Piston burettes	0,1 mL to 100 mL		
Graduated and Volumetric pipettes	1 mL to 200 mL		
Cylinders	1 mL to 2000 mL		
Proving tanks and standard test measures (Gravimetric method)	1 L to 1500 L	0,01 %	
Proving tanks and standard test measures (Volumetric method)	1 L to 5000 L	0,02 %	
Plain volume measure	1 mL to 1500 mL	0,03 %	
Syringe pumps and peristaltic pumps	0,12 mL/h a 600 mL/h	(2,5 a 0,3)%	
Flow meters and infusion analysers	0,12 mL/h a 600 mL/h	(2,5 a 0,3) %	



- Expanded Uncertainty presented in the CMC: BIPM

### Methods for the calibration of volume and flow instruments:

#### Gravimetric Method



Mass comparator with a maximum range of 20 g and mass standards

The instrument is weighted empty and dried and then weighted full with the calibration liquid. The difference between the two mass values gives the mass of the contained liquid; usually water, converted then to volume using the formula described in ISO 4787. If we consider the time, flow can also be determined.

#### Volumetric Method



Volumetric standards from 1 L to 20 L

A constant volume of water previously calibrated by gravimetric method is transferred to the instrument under calibration, according to guide EURAMET cg-21.

In this method the standards are automatic pipettes or automatic volumetric standards up to 1000 L.

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#### VOLUME and FLOW LABORATORY

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