

# VICE DIRECTORATE OF PHYSICAL METROLOGY

## Course: Large Volume Metrology

### Intended for:

The course is designed for professionals and technicians whose activities relate to the magnitude of volume.

### Identification:

Course name	Large Volume Metrology	Course duration	24 hours
Minimum # of slots	Four (4) people	Maximum # of slots	Eight (8) people
Place	The courses are taught in the Instituto Nacional de Metrología, located on Avenida Carrera (AK) 50 No. 26-55, Int 2 (CAN), Bogotá D.C.	Cost	Resolution & current rate
For information & registration: <a href="http://www.inm.gov.co">www.inm.gov.co</a> link <a href="http://www.inm.gov.co/index.php/serviciosinm/capacitacion">http://www.inm.gov.co/index.php/serviciosinm/capacitacion</a> Tel. (571) 254 22 22 extensions 1417 & 1428			

### Course Objective:

GENERAL OBJECTIVE: provide theoretical and practical tools for the calibration of Metal Volumetric Containers and glass standards using the gravimetric and volumetric method.

1. Present basic concepts such as Volume, Capacity, Calibration, Adjustment, and others, so that the participants understand the foundation of calibration methods for this magnitude.
2. Describe the most common volumetric tools in the industry and in laboratories, emphasizing their operational use (contain-supply) to be able to choose the most appropriate calibration method.
3. Present the calibration methodology used for metallic volumetric containers (gravimetric method), based on the recommendations of the International Organization of Legal Metrology-OIML R 43 Edition 1981 (E) and OIML R 120 Edition 2010 (E).
4. Provide the elements that allow for course participants to perform uncertainty estimates of the gravimetric method, using as a reference ISO/TR 20461:2000(E), in its first edition.
5. Present the basic methodology for calibrating metallic volumetric containers under the (volumetric) comparison technique, emphasizing possible corrections to the method and the selection of reference standards, by following the guidelines of EURAMET guidecg-21Version 1.0 (04/2013).
6. Propose an uncertainty budget for the Volumetric method, following the guidelines of EURAMET Guide cg-21Version 1.0 (04/2013).
7. Provide the elements that allow for course participants to prepare calibration certificates in the magnitude of volume and, at the same time, give metrological compliance to the volumetric containers according to their specific requirements.

## Course Content:

### Day One

1. Basic metrological concepts applicable to volume, units that correspond to the magnitude, and concepts related to the Archimedes Principal (fluid, density, thrust, etc.)
2. Direct measurement method and description of volume measuring instruments (instruments for containing and supplying)
3. Meniscal volume analysis
4. Verifying weighing instruments, calculating water density (Tanaka Equation), and calculating air density (Equation OIML R 111-1 Edition 2004 (E))
5. Gravimetric Method for calibrating Metal Volumetric Recipients and Glass Standards based on the recommendations of documents OIML R 43 Edition 1981 (E) and OIML R 120 Edition 2010 (E), operational sequence and recommendations

#### Practices:

- Determination of water and air density by way of real measurements of calibration conditions (environmental conditions and working fluid)
- Activity sequence during the calibration of instruments to retain the gravimetric method: 5 gallon and 20 L metal volumetric containers
- Calibrating Metal Volumetric Containers to facilitate the gravimetric method

### Day Two

1. Determination of water and air density through real measurements of calibration conditions (environmental conditions and working fluid)
2. Description of the sequence of operations during the calibration of metal volumetric containers under the (Volumetric) comparison technique, emphasizing possible corrections to the method and the selection of reference standards (recommendations of EURAMET Guide cg-21 Version 1.0 (04/2013))

#### Practices:

- Activity sequence during the calibration of instruments to retain the Volumetric method: 5 gallon and 20 L metal volumetric containers
- Calibrating Metal Volumetric Containers to facilitate the gravimetric method

### Day Three

1. Estimating uncertainty of the gravimetric method based on ISO/TR 20461:2000(E)
2. Uncertainty budget for the Volumetric method
3. Metrological assurance of Volumetric Instrument Standards
4. Description of the characteristics of metal volumetric container certificates and their importance in the industry

### Requirements

Participants should:

1. Have taken the Basic Metrology Course
2. Have taken the Measurement Uncertainty Course
3. Have basic knowledge of differential calculus, algebra, and basic statistics
4. Have access to a laptop computer for the course's practical exercises

### Important Information

In the event of partial attendance (missing more than 20% of the course) on the part of the participant, the INM will not award an "Attendance Certificate" or refund money from the course payment.

The courses are taught in the Instituto Nacional de Metrología located on Avenida Carrera (AK) 50 No. 26-55, Int 2 (CAN), Bogotá D.C., from 8:15 to 17:00 hours.

Users should consult about the availability of space before depositing payment: Tel. (571) 254 22 22 extensions 1417 & 1428.